U.S. SOLAR AND CONSERVATION TECHNOLOGIES IN INTERNATIONAL MARKETS

HEARINGS

BEFORE THE

SUBCOMMITTEE ON
ENERGY DEVELOPMENT AND APPLICATIONS

AND THE

SUBCOMMITTEE ON
INVESTIGATIONS AND OVERSIGHT

OF THE

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SCIENCE AND TECHNOLOGY
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*On assignment to Budget Committee for 97th Congress.

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U.S. SOLAR AND CONSERVATION TECHNOLOGIES IN INTERNATIONAL MARKETS

THURSDAY, JUNE 3, 1982

House of Representatives, Committee on Science and Technology, Subcommittee on Energy Development and Applications, and the Subcommittee on Investigations and Oversight,

Washington, D.C.

The subcommittees met, pursuant to notice, at 9:45 a.m., in room 2318, Rayburn House Office Building, Hon. Don Fuqua (chairman of the Subcommittee on Energy Development and Applications) presiding.

Mr. Fuqua. The joint meeting will be in order.

It is a pleasure to welcome our witnesses, guests and the members of the Energy Development and Applications Subcommittee and the Investigations and Oversight Subcommittee to the first of two joint hearings on "U.S. Solar and Conservation Technologies in International Markets."

In these troubled economic times the ability of American technologies to compete for markets with international challengers has become a subject of intense national concern. We in Congress have engaged in long debates about whether the Government is doing enough to promote American products abroad, to protect American goods domestically, and to maintain our industry's productivity and competitive strength.

One area where many of us hoped these concerns would never materialize was in energy, especially in solar and conservation technologies. Two years ago the American solar industry was second to none. American products dominated world markets. Foreign governments sent their RD&D teams to our laboratories to imitate our technology.

U.S. Government expenditures for renewable energy RD&D, including geothermal, exceeded the combined total of that of West Germany, Japan, France, Sweden, and the United Kingdom by 60 percent.

In the energy efficiency area we put together a formidable RD&D program in buildings and community systems, industrial energy conservation and transportation. In 1980 that conservation RD&D program nearly equalled in budget the combined total of the five nations I mentioned earlier.

With the new administration all that has changed. The President's budget request for fiscal year 1983 would put us behind Canada, Sweden, and the Netherlands, countries with 10 percent of our population, or less, in spending for energy efficiency RD&D. Our photovoltaics program would take a back seat to Japan and Germany. Our wind program would fall behind those of Germany and Sweden.

The issue we want to address today, however, is not whether we are spending more or less than our competitors. It is whether the dramatic cutbacks in Federal RD&D spending on conservation and solar technologies proposed by the administration will place American manufacturers at a competitive disadvantage in the eighties.

Can American companies compete on their own in world markets against well-financed government-industry teams from abroad? Should they be asked to? Can the United States afford a free-market approach to conservation and solar technology development when our industrial competitors are providing heavy subsidies?

At this point I would like to place in the record a statement by Congressman Gore, chairman of the Investigations and Oversight Subcommittee, and also the cosponsor of this hearing today.

[The opening statement of Mr. Gore follows:]

COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
WASHINGTON, D.C. 20515

OPENING STATEMENT
HONORABLE ALBERT GORE, JR., CHAIRMAN
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT
June 3, 1982

It is my pleasure to join with Chairman Fuqua in welcoming the witnesses to this joint hearing. Yesterday, the Investigations and Oversight Subcommittee heard about how America's lead in robotics technology is slipping and how other nations, particularly Japan, are automating their basic industries at a much more rapid pace than is the United States. We heard testimony about how the United States appears to be losing and, indeed, in some areas where it was once pre-eminent, has already lost its competitive edge. Today, as Chairman Fuqua has so well stated, the United States is losing out in the international arena and domestic market as well.

I would like to elaborate upon what Chairman Fuqua said about competitiveness. Once the United States was a market unto itself; this country could and did support emerging industries; imports were absorbed without adversely affecting our domestic industry. However, the size of our market made it a very attractive target for foreign industry and a trickle of imports soon became a flood. While our market was (and is) very large, we reached a point where the imports began to adversely affect our domestic industries: steel, automobiles, TV and electronics, and so on.

Another consequence of the very size of our domestic markets has been a neglect of the international markets. Historically, our industry has not needed the access to international markets in order to survive and prosper. Consequently, we have not developed the necessary institutions which are needed to successfully market on the international scene. And now that we need the access to these markets, we are starting to learn just how far behind the Japanese and the Germans and the French we are in terms of the total effort which results in successful exports.

While these points apply to many technologies, I believe that it is especially critical that we do not permit our solar energy, renewable energy, and energy conservation industries to falter. These are the very areas upon which we will depend for energy in the future; they are too important to neglect.

Mr. **Fuqua**. The first witness will be Mr. Jim Corr, senior associate of DHR Inc., to be followed by Henri-Claude Bailly, president, Hagler-Bailly, Inc., and Dr. Henry Kelly, executive director, American Council for an Energy Efficient Economy.

Mr. Corr, we would be pleased to hear from you at this point.

STATEMENTS OF JAMES CORR, PRIVATE CONSULTANT, FORMERLY SENIOR ASSOCIATE, DHR, INC.; HENRI-CLAUDE BAILLY, PRESIDENT, HAGLER-BAILLY, INC.; HENRY KELLY, EXECUTIVE DIRECTOR, AMERICAN COUNCIL FOR AN ENERGY EFFICIENT ECONOMY

Mr. **Corr**. Thank you, Mr. Chairman.

I would like to thank you and thank the committee for offering me an opportunity to address you on a subject of this importance. I was until recently senior associate with DHR, Inc., a Washington-based management consultancy, and before that I served as a special policy adviser to Prime Minister James Callaghan of Great Britain. I should state that the opinions expressed in my testimony are mine and not necessarily those of DHR.

In the fall of 1981, DHR Inc., undertook an analysis for the U.S. Department of Energy of spending by foreign countries on solar and conservation research, development, and demonstration [RD&D]. The countries studied comprised the United Kingdom, France, West Germany, Sweden, the Netherlands, Canada, Australia, and Japan.

The results of this review indicate that significant differences exist between the emphasis of U.S. programs and programs in foreign countries. In general, the U.S. Department of Energy historically placed less relative emphasis than other developed countries' energy agencies on conservation R&D, short-term commercialization research, information transfer programs, and on developing or strengthening export industries. These differences have been intensified in 1982 by the reductions that have taken place in U.S. programs, and, as you noted, Mr. Chairman, will become more dramatically pronounced if the cuts proposed by the administration for 1983 take effect.

The U.S. solar budget, as a percentage of total energy RD&D, historically was more comparable with that of other countries, although that too will be one of the smaller percentages if the 1983 budget request is passed.

The absolute and relative sizes of private conservation and solar spending are more difficult to judge than public investment. What little data are available suggest that the U.S. conservation and solar industries have been among the strongest in terms of absolute R&D spending, although when compared to GDP or energy consumption these research budgets are relatively small.

Looking now at the government sector—of the countries studied, only Japan spent less in 1980, the last year for which statistics are available for all nine countries, on conservation, as a percentage of its overall energy RD&D budget than did the United States.

Canada, the Netherlands, and especially Sweden, spent considerably more on conservation than the United States, in Sweden's case, 27 percent of its energy R&D budget, while West Germany, the United Kingdom, and Australia spent slightly more.

If total primary energy consumption is used to weight the relative size of conservation budgets to reflect the fact that countries with greater consumption probably have greater conservation potential, then the United States also spends considerably less than the developed country average.

Unless other countries cut back conservation budgets severely for 1983, the United States will, in the coming year, spend less on conservation RD&D, as a percentage of the energy budget and per unit of primary energy consumption, than any of the other countries studied.

U.S. solar research spending, relative to the total U.S. energy R&D budget in 1980, was third among the countries examined, falling far behind Sweden and also behind France. It should also be mentioned that France plans to triple its research budget in renewables between 1981 and 1985. U.S. solar research spending is somewhat higher as a fraction of the total energy budget than renewables budgets in Canada, Australia, and the Netherlands, and two or three times higher than the budgets in the United Kingdom, West Germany, and Japan.

However, there are areas within these budgets that are particularly significant, and I am going to mention those later. On the other hand, if the U.S. solar budget is reduced in 1983 to a quarter or even less of its 1980 level, as is proposed, it will undoubtedly become one of the lowest as a percentage of total energy spending, in the developed economies, and will in fact fall below, even in absolute terms, the levels of several countries much smaller than the United States.

In addition to differences in budget levels between the United States and other advanced industrial countries, the U.S. conservation and solar programs differ qualitatively from those of other countries in a variety of important ways.

For example, the U.S. programs focus much more on medium- and long-term R&D while foreign governments' primary goals appear to be near-term displacement of oil consumption and an increase in self-sufficiency. As a consequence, their programs' major thrusts are product development, information transfer, and rapid incorporation of energy savings measures or alternative sources of supply into the industrial, building, and transportation sectors.

Also, in order to help insure that industry picks up technologies when Government programs stop developing them, a large portion of foreign research ventures are cost-shared. Only a small amount of foreign R&D money is allocated through competitive solicitation.

A number of other developed countries, especially Sweden, and to a lesser extent the United Kingdom, Canada, and Japan, have adopted a variety of performance standards and mandated or provided financial assistance for energy audits, or introduced similar measures to hasten the introduction of solar and especially conservation technologies.

Finally, a greater emphasis is placed in foreign countries on developing technologies specifically for export and on introducing conservation to cut costs in industries that must compete in the international market.

For example, the German and Japanese PV programs, portions of the Canadian solar program, and the Swedish industrial conservation effort are specifically geared either to developing alternative energy export industries, or maintaining a competitive edge in established export markets.

Although the United States has had the most extensive R&D program in a variety of solar and some conservation areas, measured in absolute dollar terms, the United States could still profit from closer cooperation with foreign governments in a number of areas.

In particular, the industrial conservation programs in Sweden, West Germany, the United Kingdom, and, to a lesser extent, Japan, support a range of research related to the metallurgical, chemical, and foodstuff industries from which U.S. industry might benefit considerably. These programs are much more closely tied to reducing consumption in critical energy-intensive industries than are the analogous U.S. programs.

With regard to other conservation areas, the Swedes and West Germans are supporting extensive district heating programs far more comprehensive than any related U.S. effort. Basic technical inquiries, demonstrations, and studies on how to integrate district heating with solar energy and into urban energy systems are all being supported.

In the solar area, the Swedish and German wind programs, the German and Japanese photovoltaic programs, the British ocean and the Japanese geothermal efforts appear to be the most worthy of close examination by U.S. program planners.

I would like to say a very brief word about private RD&D. Private RD&D is far more difficult to assess than government spending, and is an area that is certainly worth further investigation. Nonetheless, figures gathered by the International Energy Agency suggest that, at least in 1980, the U.S. solar and conservation industries were quite strong in their research capacity. Because conservation technologies are very broad in scope, it would be hazardous to specify which nation has the sharpest technical edge, though Japanese industry, relative to its size, appears to be outspending other nations' industries.

Qualitative discussions suggest that the United States, Japan, and Germany are the leading nations in direct solar technology, such as photovoltaics, flat plate and concentrating collectors, while Italy, according to IEA statistics, appears to be the world leader in geothermal technology, with $36.7 million private RD&D spent in 1980. Other solar markets, wind, biomass, OTEC, remain too small or dispersed, I believe, to suggest confidently that any one country has such a strong technical lead that it is in a position to dominate future world markets.

Now I would like to focus briefly on two areas of energy R&D in which foreign countries have undertaken significant efforts, often as a result of close government-industry interaction. One of these is in solar, the other in conservation. One deals with a new, archtypical high technology industry, photovoltaics, the other with an older basic industry but one which remains fundamental even to advanced economies, steel.

To take steel first, steel is an immensely important industry from the point of view of the domestic economy, international competition, and national security. And from the point of view of energy consumption. In the United States this industry alone accounts for 4 to 5 percent of annual primary energy consumption.

In other countries the picture is similar, and it is not surprising that they have devoted a good deal of government money directly to the support of their steel industries and to R&D aimed at improving competitiveness through the more efficient utilization of energy.

I don't think we have time for a detailed account of foreign R&D and I would draw your attention to a report by DHR specifically on this issue which I would like to place in the record.

This report shows how the United States has fallen behind its major competitors in adopting the most advanced energy technologies in steel production, such as continuous casting, modern blast furnaces, electric arc furnaces, and so on. In the past 20 years or so the Japanese Government has spent more than twice as much per year as the U.S. Government on ferrous industry R&D and is increasing its commitment in this area.

The West German Government has a whole series of very innovative projects linking steel production with district heating. The result of all this is going to be increased competition not only in steel production but also in selling steel technology to those developing countries which are emerging as major steel producers based on their cheap labor advantage.

Turning now to photovoltaics, it was thought until recently that the United States was supreme and would remain so for some time to come. I am afraid we cannot be as confident today. Although there are strong U.S. companies conducting advanced research in photovoltaics, there is a growing threat from other countries.

Germany, for example, jointly develops and tests photovoltaic power generation with a number of developing countries including Egypt, Argentina, Brazil, the People's Republic of China, Indonesia, Mexico, the Sudan, and the Philippines. Such cooperation will very probably assist the penetration of German solar technologies into these countries.

It is worth noting that over 50 percent of the 1980 Federal solar budget in Germany went to photovoltaics R&D. And this R&D is not aimed at the domestic market where the annual average level of solar radiation is approximately 110 W/m^2, compared to an annual average level of more than double this, 250 W/m^2, in Texas, for example.

The Japanese have not been a highly visible factor in the world PV market in terms of overall sales so far. But they have achieved some significant technical successes and are expanding their efforts in this area at a very rapid rate. The Japanese Government R&D budget for photovoltaics increased by 258 percent between fiscal year 1980 and fiscal year 1981, from Y1.2 billion to Y4.3 billion, and by a further 56 percent in fiscal year 1982 to Y6.7 billion; or, in other words, it has more than quintupled in 2 years.

At current exchange rates, this represents a program of about $28.2 million. I think it is worth noting that the administration request for PV research in fiscal year 1983 is $27 million. If that request were passed and if Japanese spending continued to increase, and current intentions are that it will, then next year Japan will be spending much more than the United States on a dollar-for-dollar basis, taking no account of the fact that U.S. GNP is about 2½ times the size of Japan's.

Thus, while the United States holds a technological and market lead at the moment, the aggressive R&D and demonstration strategies of its competitors pose a significant threat for the future.

To sum up, I would like to say that there is evidence that the United States energy R&D programs are in danger of falling well behind those of foreign competitors both in research into new, so-called high technologies, and in developing and applying the techniques that can resuscitate older, so-called declining industries.

It is noticeable that in the administration's budget request for 1983, the proposed cuts fall almost entirely in conservation, solar, and advanced fossil technologies, while nuclear remains untouched. This is in striking contrast to other nations which continue to pursue multidirected energy programs.

There is, as far as I am aware, no evidence that those countries are cutting back on their conservation and solar R&D to anything like the same extent proposed by the administration, and indeed several are proposing significant expansions.

I am convinced that the efficient use of energy will remain a major concern of consumers and manufacturers here in the United States and overseas despite the current relatively favorable oil supply situation. Therefore, to reduce R&D so drastically in these crucial areas is, to use a British expression, a classic example of penny-wise and pound-foolish.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Corr follows:]

Prepared Statement of James Corr, Private Consultant

INTRODUCTION

In the fall of 1981, DHR, Incorporated undertook an analysis for the U.S. Department of Energy of spending by foreign countries on solar and conservation research, development, and demonstration (RD&D). The countries studied comprised the United Kingdom, France, West Germany, Sweden, the Netherlands, Canada, Australia, and Japan.

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LOOKING NOW AT THE GOVERNMENT SECTOR

Of the countries studied, only Japan spent less in 1980 (the last year for which statistics are available for all nine countries) on conservation, as a percentage of its overall energy RD&D budget, than did the U.S., Canada, the Netherlands, and especially Sweden spent considerably more on conservation than the U.S.—in Sweden's case, 27 percent of its energy R&D budget—while West Germany, the United Kingdom, and Australia spent slightly more. If total primary energy consumption is used to weight the relative size of the conservation budgets (to reflect the fact that countries with greater consumption probably have greater conservation potential) then the U.S. also spends considerably less than the develoed country average. Unless other countries cut back conservation budgets severely for 1983, the U.S. will, in the coming year, spend less on conservation RD&D, as a percentage of the energy budget and per unit of primary energy consumption than any of the other countries studied.

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To take steel first, steel is an immensely important industry from the point of view of the domestic economy, international competition, and national security. And from the point of view of energy consumption—in the U.S. this industry alone accounts for 4 percent-5 percent of annual primary energy consumption. In other countries the picture is similar and it is not surprising that they have devoted a good deal of government money directly to the support of their steel industries and to R&D aimed at improving competitiveness through the more efficient utilization of energy. This report shows how the U.S. has fallen behind its major competitors in adopting the most advanced energy technologies in steel production—such as continuous casting, modern blast furnaces, electric arc furnaces, and so on. In the past twenty years or so the Japanese government has spent more than twice as much per year as the U.S. govenment on ferrous industry R&D and is increasing its commitment in this area. The West German government has a whole series of very innovative projects linking steel production with district heating. The result of all this is going to be increased competition not only in steel production but also in selling steel technology to those developing countries which are emerging as major steel producers based on their cheap labor advantage.

Turning now to photovoltaics, it was thought until recently that the U.S. was supreme and would remain so for some time to come. I am afraid we cannot be as confident today. Although there are strong U.S. companies conducting advanced research in photovoltaics, there is a growing threat from other countries. Germany, for example, jointly develops and tests photovoltaic power generation with a number of developing countries including Egypt, Argentina, Brazil, the People's Republic of China, Indonesia, Mexico, the Sudan, and the Philippines. Such cooperation will very probably assist the penetration of German solar technologies into these countries. It is worth noting that over 50 percent of the 1980 Federal solar budget in Germany went to photovoltaics R&D. And this R&D is not aimed at the domestic market where the annual average level of solar radiation is approximately 110W/m^2, compared to an annual average level of more than double this (250W/m^2) in Texas, for example.

The Japanese have not been a highly visible factor in the world PV market in terms of overall sales—so far. But they have achieved some significant technical successes and are expanding their efforts in this area at a very rapid rate. The Japanese government R&D budget for photovoltaics increased by 258 percent between fiscal year 1980 and fiscal year 1981 (from Y1.2 billion to Y4.3 billion) and by a further 56 percent in fiscal year 1982 to Y6.7 billion; or, in other words it has more than quintupled in two years. At current exchange rates this represents a program of about $28.2 million. I think it is worth noting that the Administration request for PV research in fiscal year 1983 is $27 million. If that request were passed and if Japanese spending continued to increase (and current intentions are that it will), then next year Japan will be spending much more than the U.S. on a dollar for dollar basis, taking no account of the fact that U.S. GNP is about 2½ times the size of Japan's. Thus, while the U.S. holds a technological and market lead at the moment, the aggressive R&D and demonstration strategy of its competitors poses a significant threat for the future.

To sum up, I would like to say that there is evidence that the U.S. energy R&D programs are in danger of falling well behind those of foreign competitors both in research into new, so-called "high" technologies, and in developing and applying the techniques that can resuscitate older, so-called "declining" industries. It is noticeable that in the Administration's Budget Request for 1983, the proposed cuts fall almost entirely in conservation, solar, and advanced fossil technologies, while nuclear remains untouched. This is in striking contrast to other nations which continue to pursue multi-directed energy programs. There is, as far as I am aware, no evidence that those countries are cutting back on their conservation and solar R&D to anything like the same extent proposed by the Administration, and indeed several are proposing significant expansions. I am convinced that the efficient use of energy will remain a major concern of consumers and manufacturers here in the U.S. and overseas despite the current relatively favorable oil supply situation. Therefore, to reduce so drastically R&D in these crucial areas is, to use a British expression, a classic example of "penny wise and pound foolish".

TABLE 1.—TOTAL FEDERAL GOVERNMENT R&D BUDGET FOR ENERGY CONSERVATION

[Dollars in millions]

	1979		1980		1981	
	Dollars	Percent [1]	Dollars	Percent [1]	Dollars	Percent [1]
United Kingdom	[2] 34.7	[2] 8.9	[3] 27.62	[3] 6.25	NA	NA
West Germany	[2] 45.1	[2] 4.3	[3] 70.52	[3] 6.71	NA	NA
Japan	[2] 51.3	[2] 5.6	[3] 32.04	[3] 2.42	[6] 61.3	[6] 3.9
Australia	NA	NA	[3] 2.22	[3] 6.11	NA	NA
Canada	[4] 10.7	[4] 7.7	[3] 24.38	[3] 9.46	[4] 13.6	[5] 7.9
Sweden	[2] 34.2	[2] 32.0	[3] 34.10	[3] 27.00	[6] 45.7	[6] 34.1
Netherlands	[2] 14.5	[2] 12.9	[3] 23.64	[3] 15.00	[7] 22.3	[7] 14.8
France	[8] 80.9	NA	[8] 92.40	[6] 9.70	NA	NA
United States	[2] 211.7	[2] 5.6	[3] 252.80	[3] 6.01	[6] 292.5	NA

[1] As a percentage of total Government R&D energy budget.
[2] IEA, Energy Research, Development and Demonstration in the IEA Countries, 1979 Review of National Programmes, 1980.
[3] IEA, Energy Research, Development and Demonstration in the IEA Countries, 1980 Review of National Programmes, 1981.
[4] National Energy Program 1980, Energy, Mines and Resources Canada.
[5] Canadian Embassy.
[6] DHR Estimate.
[7] Embassy of the Netherlands.
[8] French Ministry of Industry, Les chiffres cles: Energie 1981, 1981.

TABLE 2.—TOTAL FEDERAL GOVERNMENT R&D BUDGET FOR SOLAR (RENEWABLES)

[Dollars in millions]

	1979		1980		1981	
	Dollars	Percent [1]	Dollars	Percent [1]	Dollars	Percent [1]
United Kingdom	[2] 19.1	[2] 4.9	[3] 24.7	[3] 5.60	NA	NA
West Germany	[2] [4] 46.4	[2] 4.4	[4] 65.7	[3] 6.26	NA	NA
Japan	[2] 38.5	[2] 4.2	[3] 88.82	[3] 6.71	[6] 96.7	[6] 6.12
Australia	NA	NA	[3] 5.21	[3] 14.32	[5] 9.7	NA
Canada	[2] 18.5	[2] 13.3	[3] 34.30	[3] 13.31	NA	NA
Sweden	[2] 32.0	[2] 30.0	[3] 44.9	[3] 35.58	[6] 50.7	[6] 37.80
Netherlands	[2] 10.0	[2] 9.0	[3] 18.06	[3] 11.47	[7] 16.5	[7] 11.00
France	NA	NA	[5] 230.00	[5] 24.20	[5] 255.0	NA
United States	[2] 624.2	[2] 16.5	[3] 731.20	[3] 17.39	[6] 598.8	na

[1] As a percentage of total government R&D energy Budget.
[2] International Energy Agency, Energy Research, Development and Demonstration in the IEA Countries, 1979, Review of National Programmes, 1980.
[3] International Engery Agency, Energy Research, Development and Demonstration in the IEA Countries, 1980 Review of National Programmes, 1981.
[4] Government Accounting Office, Industry Views on the Ability of the United States Photovoltaics Industry to Compete in Foreign Markets, September 15, 1981.
[5] French Ministry of Industry, Les Chiffres Cles: Energie 1981, 1981.
[6] DHR Estimate.
[7] Embassy of the Netherlands.
[8] La Politique Solaire de la France, Based on 1981 current exchange rate.

TABLE 3.—TOTAL FEDERAL GOVERNMENT R&D BUDGET FOR ENERGY CONSERVATION PER UNIT PRIMARY ENERGY CONSUMPTION[1]

[In millions dollars per quad]

	1979		1980		1981	
	Millions of dollars	Millions of dollars	Millions of dollars	Millions of dollars per quod	Millions of dollars	Millions of dollars per quod
United Kingdom	34.7	3.65	27.52	2.89	NA	NA
West Germany	45.1	3.66	70.52	5.68	NA	NA
Japan	51.3	3.22	32.04	1.90	61.3	3.44
Australia	NA	NA	2.22	0.61	NA	NA
Canada	10.7	1.12	24.38	2.46	13.6	1.32
Sweden	34.2	15.69	34.10	15.49	45.7	20.56
Netherlands	14.5	4.89	23.64	7.79	22.3	7.19
France	80.9	9.91	92.40	11.17	NA	NA
United States	211.7	2.62	252.80	3.10	292.5	3.50

[1] Source: DHR estimates based on IEA energy budget data (see other tables) and IEA energy consumption data.

TABLE 4.—FEDERAL SOLAR AND CONSERVATION R&D BUDGET PER CAPITA[1]

	1979	1980	1981
United Kingdom	[2]0.96	[3]0.94	NA
West Germany	[2]1.50	[3]2.24	NA
Japan	[2].78	[3]1.04	[4]1.35
Australia	NA	[3].51	NA
Canada	[2]1.23	[3]2.44	NA
Sweden	[2]8.02	[3]9.57	[4]11.66
Netherlands	[2]1.75	[3]2.96	[5]2.74
France	NA	[4]6.08	[6]4.81
United States	[2]3.79	[3]4.43	[4]3.87

[1] Based on populaiton estimates for 1979, 1980, and 1981 from World Population Trends and Prospects by Country, 1950-2000, United Nations, 1979.
[2] IEA, Energy Research, Development and Demonstration in the IEA Countries, 1979 Review, 1980.
[3] IEA, Energy Research, Development and Demonstration in the IEA Countries, 1980 Review, 1981.
[4] DHR estimate.
[5] Based on information supplied by the Embassy of the Netherlands.
[6] Renewables alone.

TABLE 5.—RATIO OF FEDERAL SOLAR AND CONSERVATION R&D BUDGET TO GDP

[Per mille]

	1979	1980	1981[1]
United Kingdom	[2]0.14	[3]0.21	NA
West Germany	[2].12	[3].27	NA
Japan	[2].09	[3].18	[4]0.247
Australia	NA	[3].07	NA
CaNAda	[2].13	[3].30	NA
Sweden	[2].65	[3]1.03	[4]1.26
Netherlands	[2].16	[3].44	[5].41
France	NA	[4].81	[6].64
United States	[2].36	[3].54	[4].49

[1] Based on 1980 GDP, SOURCE: OECD Main Economic Indicators.
[2] IEA, Energy Research, Development and Demonstration in IEA Countries, 1979 Review, 1980.
[3] IEA Energy Research, Development and Demonstration in IEA Countries, 1980 Review, 1981.
[4] DHR estimate.
[5] Based on information supplied by the Embassy of the Netherlands.
[6] DHR estimate, renewables alone.

TABLE 6.—PRIVATE RD&D SPENDING FOR SOLAR AND CONSERVATION IN 1980

[Dollars in millions]

	Conservation	Solar
West Germany	[1] 35.31	[1] 32.95
Japan	336.59	59.64
Netherlands	19.27	6.54
United Kingdom	[2] 19.28	1.16
United States	476.20	41.60

[1] This figure includes only the industry share of public/private cost-shared ventures. Exlusively private investment, which is considerable, has not been estimated by the IEA.

[2] This includes only spending by the nationalized British industries.

TABLE 7.—*Private industry conservation RD&D spending per unit or primary energy consumtion in 1980 (dollars in million/quad)* [1]

West Germany	[2] 2.82
Japan	18.87
Netherlands	6.21
United Kingdom	[3] 2.01
United States	5.78

[1] Source: Table 6 and IEA figures for total primary energy consumption.

[2] Based on private share of cost-shared research only.

[3] Based on UK nationalized industries' RD&D alone.

Mr. GORE. Thank you very much. We will withhold questions until the panel has completed its questions.

Mr. Bailly.

Mr. BAILLY. Thank you very much, Mr. Chairman.

The focus of my testimony today will be the status of European and Japanese industrial energy conservation policies and programs, particularly as they relate to the development of energy-efficient technologies.

Over the past 2 years our firm has conducted numerous market studies of energy conservation technologies for many U.S. and foreign clients. As part of these studies we also are involved in assessing foreign governments' research, development, and demonstration programs, particularly in the area of industrial energy conservation.

Today I would like to talk about a study which we recently completed on government-sponsored industrial energy conservation policies and programs in five countries—West Germany, France, the United Kingdom, Sweden, and Japan.

It is, of course, not possible in the 10 minutes that I have for my testimony to discuss in detail each country's programs and policies, but I believe that three general conclusions can be drawn from our review.

The first conclusion is that this year, for the first time, the U.S. Government will probably spend less on industrial energy conservation research, development, and demonstration than any of the countries considered. Indeed, despite reductions in overall public sector expenditures in some of these countries, all five of them are maintaining or increasing the level of their past efforts in industrial energy conservation.

Our estimates of public sector expenditures in calendar year 1982 are as follows: West Germany will be spending approximately $25 million; France, $35 million; Japan, $8 million; Sweden, $40 million, and the United Kingdom, $39 million.

Our estimates, according to many of the officials whom we interviewed and who reviewed the estimates, are very conservative. Since the latter part of 1981, new developments have taken place that could push our figures substantially upwards for some countries.

For example, the French have recently reorganized their energy conservation programs and created the Agency for Energy Management [Agence Francaise pour la Maitrise de l'Energie]. This new agency will place national energy conservation efforts on a par with nuclear and fossil development efforts. The French Government will probably more than triple its spending in some areas of the industrial sector.

The second conclusion from this review has nothing to do with budgets. Contrary to the view generally held in the United States, market laissez-faire has been the major policy instrument of most European countries and Japan; regulatory intervention in the industrial sector has been kept to a minimum. However, RD&D, information, and advisory programs are considered integral and permanent components of each country's industrial energy conservation policy.

The overall goal of each country is to improve its balance of payments by minimizing oil imports and improving the competitiveness of its industrial sector. To achieve this goal, all of the countries use a wide variety of policy tools to supplement the incentive to save energy that is inherent in rising energy prices. While the United States has employed several of these tools in the past, it has failed to pursue a consistent policy in their use.

The third and final general conclusion that can be drawn from our study is that technology development programs in these countries differ substantially from those currently being implemented in the United States.

First, their RD&D activities, as you heard fom James Corr, are heavily oriented toward the near-term marketability of results. The primary components of all projects are engineering development and commercial demonstration rather than basic or even applied research.

For instance, more than three-fourths of the French Government's industrial energy conservation expenditures are related to development and demonstration projects, and no more than 15 percent to basic research. This breakdown illustrates the government's commitment to near-term, that is, two to three year applications of energy-saving technologies. Most of the French efforts are directed at the development of more efficient existing technologies, such as the development of corrosion-resistant heat exchangers or the demonstration of existing equipment in new energy-saving applications, for example, the use of heat pumps to dry wood.

All of the countries considered have also taken specific steps to insure that the RD&D results are quickly marketed. For example, most of the German RD&D is carried out by industry to insure that new technologies are commercialized as soon as possible. Since 1978, the German Government has also provided financial aid to accelerate the market introduction of energy-saving technologies and products; if I recall correctly, the terms of this aid were revised and expanded in 1979. This program, by the way, is aimed at small and medium size enterprises, which generally cannot underwrite the technical and market risks inherent in new technologies. The German Government provides up to 50 percent of the total costs qualifying for support, such as costs entailed in engineering development, market planning, and production line development.

Under this program, the German Government's financial assistance is to be repaid; however, the requirement for repayment may be totally or partially waived if the product has not been successfully introduced on the market within 3 years of receipt of the last Government payment.

Another difference between the technology programs in these countries and the programs in the United States is the explicit consideration given by these countries, when selecting projects for support, to import substitution and export potential.

For example, in evaluating proposals, the French Government considers, among other criteria, the project's ability to serve as a reference for the industrial sector as a whole by being the first to use French-made equipment or to open opportunities for export. The criteria used by the United Kingdom Government include the effect on United Kingdom industry, such as the possibility of fostering the manufacture of this equipment in the United Kingdom.

Third, foreign RD&D program management differs from U.S.-style management in several important ways.

Objectives and budgets generally cover several years, for example, 4 years in Germany, 3 in Sweden, 5 in Japan and France.

Second, industry participates, often through trade associations, in the definition of RD&D programs. In several countries, industry even participates directly in the selection of specific projects. For example, in Japan, regional advisory groups or committees that include industry representatives professionals, and scientists, as well as Government officials, play a key role in defining the Government's research program and selecting some of the projects.

Mr. GORE. Mr. Bailly, if you would forgive us, we have a significant bill on the floor, and as a result it's necessary for us to recess for about 10 minutes. We will pick up at this point in your testimony when we come back.

Mr. BAILLY. Thank you.

Mr. FUQUA. The joint meeting will resume and we will continue with the witness, Mr. Bailly.

Mr. BAILLY. Before the recess, I was in the process of discussing some of the program management differences between the United States and the five countries which we considered in our report, and I made the point that one of the major differences was that the objective and budget of each country covers multiple years.

The other point was that industry is active in the technology development and demonstration programs.

The third point, which I will make new, is that technology development in these countries is generally cost shared with industry to insure the earliest possible commercialization.

For example, we found that in Germany, industry funded, on average, 42.2 percent of all project costs. In the United Kingdom, the Government generally supports demonstration projects with direct nonrepayable grants of up to 25 percent. The United Kingdom Government also covers up to 100 percent of any necessary expenses incurred directly as a result of the demonstration, for example, the cost of monitoring energy savings by an independent body. R&D projects, on the other hand, are usually funded on a shared cost/shared return basis, with the United Kingdom Government covering up to 50 percent of costs. In such cases, the government contribution is repayable with interest if the R&D is successful and leads to commercial applications.

The foreign programs are heavily oriented toward small- and medium-size enterprises, particularly in Germany and Japan. For example, MITI's Small and Medium Enterprise Agency provides financial assistance to small businesses for R&D projects directly related to specific aspects of the manufacturing process, such as a new forging process, a bubble dyeing system for textiles, new drying techniques. The agency provides financial assistance to such research projects in three ways:

One, grants covering up to two-thirds of the total project cost for basic RD&D, compared with a 50-percent limit on support for large industrial projects;

Two, loans to support applied RD&D, and

Three, guarantee of private loans for RD&D projects.

To sum up, Mr. Chairman, on the basis of the work that we have carried out over the past few years and on the basis of the study findings, I have reached three conclusions with respect to U.S. industry.

One: In the short term, our industry, particularly small- and medium-sized companies, will be at a competitive disadvantage in the fast growing world market for industrial energy efficiency improvements. This competitive disadvantage will stem from two key factors. First, foreign technology suppliers have accumulated more experience and credibility, primarily because industrial energy prices have traditionally been higher abroad than in the United States.

Second, foreign companies, particularly small- and medium-size enterprises, will continue to receive direct subsidies from their governments to develop and market conservation technologies, while their U.S. counterparts will have to rely strictly on their own resources to carry out such activities.

Two: In the mid-term, our technological leadership in the development of conservation technologies will erode, and with it, our ability to sell many ancillary products and services. For example, in some of our work we have found that foreign firms are unlikely to be content with handing over just the technology; rather, these firms will probably insist on supplying the whole package—design, engineering, and construction services, along with manufactured components. The threat from such an insistence on purchasing goods and services clearly goes beyond the loss of sale, or for that matter, cost of import, of a specific piece of hardware.

Three: Finally, because several industries in Germany, France, and Japan are already among the most energy efficient in the world, the RD&D in these industries is shifting more and more toward the development of totally new technologies and processes rather than components to improve energy efficiency. This shift from components toward processes will in all likelihood result in overall—not just energy-related—productivity improvements.

Because the productivity gap is a moving target, we must first forecast the productivity status of these countries in the long term and then help U.S. industry to close the gap.

[The prepared statement of Mr. Bailly follows:]

Our estimates, according to many of the officials whom we interviewed and who reviewed the estimates, are very conservative. Indeed, since the latter part of 1981, new developments have taken place that could push our figures upwards for some countries substantially. For example, the French have recently reorganized their energy conservation programs and created the Agency for Energy Management (Agence Francaise pour la Maitrise de l'Energie), this new agency will place national energy conservation efforts on a par with nuclear and fossil development efforts.

Second, contrary to the view generally held in the United States, market laissez-faire has been the major policy instrument of most European countries and Japan; regulatory intervention in the industrial sector has been kept to a minimum. However, RD&D, information, and advisory programs are considered integral and permanent components of each country's industrial energy conservation policy. The overall goal of each country is to improve its balance of payments by minimizing oil imports and improving the competitiveness of its industrial sector. To achieve this goal, all of the countries use a wide variety of policy tools to supplement the incentive to save energy that is inherent in rising energy prices. While the United States has employed several of these tools in the past, it has failed to pursue a consistent policy in their use.

Finally, technology development programs in these countries differ substantially from those currently being implemented in the United States. First, their RD&D activities are heavily oriented toward the near-term marketability of results. The primary components of all projects are engineering development and commercial demonstration rather than basic and applied research. For instance, more than three-fourths of the French government's industrial energy conservation expenditures are related to development and demonstration projects, and no more than 15 percent to basic research. This breakdown illustrates the government's commitment to near-term and by that they mean two to three year applications of every-saving technologies. Most of the French efforts are directed at the development of more efficient existing technologies (such as development of corrosion-resistant heat exchangers) or the demonstration of existing equipment in new energy-saving applications (for example the use of wood drying by heat pumps).

All of the countries considered have also taken specific steps to ensure that the RD&D results are quickly marketed. For example, most of the German RD&D is carried out by industry to ensure that new technologies are commercialized as soon as possible. Since 1978, the German government has also provided financial aid to accelerate the market introduction of energy-saving technologies and products. This program which, by the way is aimed at small and medium-size enterprises, which generally cannot underwrite the technical and market risks inherent in new technologies. The German government provides up to 50 percent of the total costs qualifying for support (and by that they mean engineering development, market planning, production line development). Under this program, the government's financial assistance is to be repaid; however, the requirement for repayment may be totally or partially waived if the product has not been successfully introduced on the market within 3 years of receipt of the last government payment.

Second, in including projects for support, all countries consider import substitution and export potential. For example, in evaluating proposals, the French Government considers, among other criteria, the project's ability to serve as a reference for the industrial sector as a whole by being the first to use French-made equipment or to open opportunities for export. The criteria used by the U.K. Government include the effect on U.K. industry—for example, the possibility of fostering the manufacture of this equipment in the United Kingdom.

Third, foreign RD&D program management differs from U.S.-style management in several important ways: (a) Objectives and budgets generally cover several years (e.g., 4 years in Germany, 3 in Sweden, 5 in Japan); and (b) Industry participates, often through trade associations, in the definition of RD&D programs. In several countries, industry even participates directly in the selection of specific projects. For example, in Japan, regional advisory groups or "committees" that include industry representatives, professionals, and scientists, as well as government officials, play a key role in defining the government's research program and selecting some of the projects.

Mr. FUQUA. Now we will hear from Dr. Kelly.

Mr. KELLY. I would like to invite Howard Geller, who helped prepare the testimony, to sit with me.

I have a longer statement which I would like to submit.

Mr. FUQUA. We will make the statement part of the record.

Mr. KELLY. The technology of energy efficiency affects U.S. trade in three ways: Inefficient use of energy can put U.S. products at a competitive disadvantage in international markets simply because they are more expensive.

Second, inefficient devices designed for sale in the U.S. market where consumers might be relatively uninformed about the advantages of energy efficiency, will not be able to find large markets abroad. Foreign manufacturers may be able to move rapidly into U.S. markets in areas of energy efficiency as the U.S. public becomes more sensitive to the advantages of energy efficiency purchases.

Ultimately, if the United States doesn't make major native use of energy efficiency, the economy can suffer. The recent traumas of the U.S. automobile industry illustrate the concerns about the impact of energy on trade balance. But are automobiles a unique case? Probably not.

Rather than talk about the general isssue, I would like to spend the rest of my testimony discussing the specific cases of the U.S. appliance industry, which is a significant industry and one that is frequently overlooked. The appliance industry is important for several reasons. First, it is a reasonably sizable industry—around $13 billion a year, employs over 300,000 people directly, and U.S. appliances use a surprisingly large amount of energy.

In 1980, major appliances and lighting consumed approximately 6.3 quads, 8 percent of all the U.S energy consumption. Residential heating and cooling equipment used another 8.9 quads in 1980. There is a remarkable opportunity for a significant savings in this area. Take the example of a refrigerator. The 16–18 foot refrigerator, operating today uses around 1,650 kilowatt hours a year. The typical unit sold today uses around 1,350, so that the new sales are better than the average stock.

Amana has a new unit on the market that requires 865 kilowatt hours a year and has developed a model that requires only about 650 kilowatt hours. If you are willing to go to a partially automatic device, you can buy one that uses 690 kilowatt hours a year. The rate of return on investment in even the best Amana refrigerator, compared to the average, is around 18 percent return in constant dollars. Of course, that was above inflation. The income, of course, is tax free. Looked at that way, if an electric utility had invested the difference between the cost of that produced and the average refrigerator, the effective cost of saved energy would be 4 cents a kilowatt hour, which is a competitive price.

Refrigerators are not the only example. For instance, to improve the efficiency of gas furnaces by 46 percent, you buy the best produced now on the market. Taken together, it is possible for the economically sensible use of appliance investments to reduce U.S. appliance energy consumption up to a third over the next 20 years. If we continue business as usual, the appliance consumptions could increase by 40 percent, so we are talking about almost a factor of two.

What about foreign technology in this area? With a few exceptions there are relatively few foreign appliances sold in the United States. With the exception of refrigerators, the United States is an exporter of appliances. The U.S. market for appliance differs from that in most other countries. U.S. consumers have been able and willing to invest in clothes dryers, large refrigerators, freezers, dishwashers, while these products are not widely used abroad. In the early seventies, a Japanese refrigerator had a volume of 6 cubic feet compared to the average American refrigerator at 17 cubic feet.

One of three things has to happen, the foreign manufacturer will have to prove it is especially designed for the American market, foreign appliances might change in a way making them more acceptable to the U.S. market or the U.S. appliance markets could be shifted in a direction that makes them look more like the Europeans. Speculation is difficult, but it seems that other industrial nations are beginning to exhibit a demand for appliances that does resemble competition in the United States.

We examined data on what is available overseas and prepared a number of tables. Taking the example of refrigerators, if we look at the average efficiency of refrigerators and measure it in something called the energy factor, which is the volume cooled per unit of energy consumed. To give a perspective on the number, it averaged around six. The very best Amana refrigerator is 8.7. Toshiba has one that is 11.5 and in almost every category of refrigerators and freezers we looked at, there was a European or Japanese product better than what is available in the United States.

What also is interesting is that the Japanese seem to be making more rapid progress in improving the efficiency of their products in the United States. They started somewhat behind the United States in efficiency 10 years ago, and are now ahead of it. With air-conditioners, for example, they were 30 percent less efficient in the United States, largely because they were smaller, and they are now better.

Foreign penetration of U.S. markets has been limited to relatively specialized areas. We have made a quick survey of this. It is interesting that the penetration is occurring in a wide variety of different areas. I don't want to discuss them in detail with you, but we found an example of a multizone heating system being sold through a California distributor manufactured by a Daikin in Japan. We found an example of a very efficient double effect absorption chiller The market is part of cogeneration systems.

We found an example of a very efficient, very quiet, reliable compressor that is being marketed as a component for refrigerators and air-conditioners. Mitsubishi apparently decided that it is more attractive for them to try to sell this component than it is for them to sell an entire refrigerator air-conditioner in the United States.

The effect of this is that competition from abroad in energy-efficient appliances could come from someone selling a system, someone selling a component. It could come, as in the case of absorption air-conditioners, as something that is tailor made for a specific application. Most of the countries have been programed to encourage efficient appliances, though there is a variety around the world.

The European Common Market is doing a coordinating testing and labeling program for appliances, but has yet to reach final agreement. The Japanese are especially concerned about the impact of the growing demand for domestic appliances since they are in fact moving to larger appliances like the American market.

The Industrial Science and Technology Agency of Japan has adopted a comprehensive program to improve the efficiency of the Japanese manufacturing industry. It has a number of programs, including support of subsidies to appliance manufacturers designed to facilitate the earliest possible development of equipment featuring energy conservation. It includes establishment of energy-efficient standards. The program subsidized industrial research in the development of efficient residential appliances and provides funding for testing and marketing.

The program establishes targets for improvements based on consultations with manufacturers and provides support for competing companies to meet the target of efficiencies. The Japanese claim that the program has moved the market so rapidly that it has led to significant increases in the funds private companies are directing to research and development in appliance efficiency. Some of those efficiency goals are extremely ambitious, calling for 17 to 25 percent imporvements of products which are already efficient.

The appliance program supported by the Department of Energy has proceeded in a number of areas, as has been discussed earlier. It would be virtually eliminated by some of the budget proposals now under consideration. There is evidence, however, that at least the DOE program has succeeded in accelerating the introduction of efficient products, which may have forestalled major foreign penetration into the U.S. market.

A well-documented case is the example of the billion-dollar industry in ballast for fluorescent lighting. Several years ago there were indications that several foreign firms were interested in marketing a high-frequency ballast that would have the effect of reducing consumption of fluorescent lighting by 25 percent. The U.S. firms developed and are now introducing an identical ballast and the foreign firms no longer seem to have immediate plans for selling this device in the United States.

Encouraging purchases of efficient appliances is noe of the most economically attractive techniques now available for making the U.S. economy more efficient. An enormous amount can be done by making consumers more informed. Increased consumer interest in efficient appliances would have the effect of increasing U.S. savings rates by encouraging individual investments in technology that can do much to improve the Nation's productivity. The U.S. appliance industry is capable of matching foreign government, but the market for appliances could be very volatile with the enormous attention between what seems to be economical and what people are actually doing.

The situation could change rapidly and I think that the matter deserves careful attention of anyone interested in national energy policy.

Thank you, sir.

[The prepared statement of Dr. Kelly follows:]

PREPARED STATEMENT OF HENRY C. KELLY

1. Background

The technology of energy efficiency affects U.S. trade in a number of ways:

--Inefficient use of energy can put U.S. products at a competitive disadvantage in international markets simply because they are more expensive. Manufacturing processes that do not make productive use of energy can be a major liability in areas where energy costs represent a signficant fraction of the value of products offered for sale.

--Inefficient devices designed for sale in a U.S. market relatively uninformed about the merits of energy efficiency will not be able to find large markets in countries more sensitive to energy prices

--Foreign manufacturers may be able to move rapidly into U.S. markets if the U.S. buying public begins to demand efficient products while U.S. firms are unable to respond in a timely way.

Ultimately, of course, the entire U.S. economy could suffer if productive investments in energy efficiency are overlooked. If an investment in efficiency pays a higher return than an investment in new energy supplies, policies having the effect of artificially directing markets toward energy supply investments necessarily lower national productivity and can be inflationary. Energy productivity is not a small matter since the nation's energy bill last year exceeded 15% of the entire gross national product. Energy supply technologies required about 40% of all national capital investment in plant and equipment (1). We can not afford to be careless about where such sums are invested.

The recent traumas of the U.S. automobile industry vividly illustrate that concerns about the impact of energy efficiency on U.S. trade balances are not idle speculation. But are automobiles a unique case? Possibly not. I'd like to spend the next few minutes discussing the potenital impact of changed energy economics on a major, but frequently overlooked sector of U.S. industry--the firms that manufacture appliances and residential heating and air-conditioning equipment.

Given adequate incentives there is no reason why the U.S. industry should have anything to fear from foreign competition. But the discussion in this paper will show that the market for appliances may change rapidly during the next few years -- particularly if American consumers start to pay more careful attention to appliance efficiency. There is every reason to believe that consumer preferences may change rapidly. Appliance labels give consumers their first real opportunity to shop on the basis of efficiency and the cost of operating large appliances has reached the point where it is bound to attract attention. In Manhattan, for example, operating a large refrigerator can cost $260 per year. If the American industry is unable to move rapidly to meet new demands it could face serious problems from foreign competition.

2. The Appliance and HVAC Industry

The residential appliance industry is worth considering in the present debate for several reasons. First, it makes a significant contribution to national income and national employment. Annual sales of home appliances, furnaces, and air-conditioners are roughly $13 billion (see table 1). The industry directly employs approximately 300,000 workers.(2) A major loss of market share in appliances would clearly be a blow to the nation's economy.

Second, appliances make a suprisingly large contribution to national energy consumption. In 1980 major appliances and lighting consumed approximately 6.3 quads of energy (excluding the energy used in heating and air-conditioning)--about 8% of national energy consumption.(3) Residential heating and cooling equipment consumed another 8.9 quads in 1980. Without changes in recent sales patterns, appliance energy consumption could increase by 40% by the year 2005.(4) Since we can expect that construction practices will emphasize energy efficent building designs in the future, and many existing buildings will be retrofit to save energy, the fraction of domestic energy consumed by appliances will increase. It is interesting to notice, for example, that homes built to a standard of efficiency used by many contemporary home-builders will use more energy heating water than heating the house in all climates colder than

Washington D.C.

There is a remarkable potential for improving the performance of most classes of appliances--often at a relatively modest cost. Table 3, for example, shows that even the most efficient products now on the market are extremely good investments. Take refrigerators for example. The average 16-18 cubic foot frost free refrigerator operating in the U.S. uses about 1650 kwh per year. The typical unit sold today requires about 1350 kwh. Amana however, has a unit on the market that requires only about 865 kwh per year and has developed a model that will need only 650 kwh. If you are willing to manually defrost your freezer instead of insisting on a completely automatic defrost cycle, you can buy a refrigerator today that requires only 690 kwh. The rate of return on an investment in the best frost-free model now available is about 18% in constant dollars. And of course the income is tax free. Looked at in another way, if a utility invested in the difference between the cost of the most efficient refrigerator now available and the cost of a typical refrigerator, the cost of the saved energy would be about 4 ¢/kwh.

A significant amount of energy can be saved by improving refrigerators and freezers. These appliances use an amount of electricity equal to about 85% the output of all operating nuclear generating plants. A technology able to reduce this demand by a factor of three is equivalent to freeing 2/3 of the nuclear industry for other uses.

Table 3 indicates that many other categories of appliances can achieve significant improvements in efficiency, often at relatively modest cost. Heat pumps and devices for saving hot water can greatly reduce the energy needed to supply domestic hot water. Advanced designs currently available can improve the performance of a typical 1980 gas furnace by 46%. If all fuel-fired central space heaters in 1980 were as efficient as the best models now available, the total energy savings would amount to the equivalent of approximately 600,000 barrels of oil per day. The efficiency of lighting can be improved using advanced bulbs and by shifting to flourescents wherever possible. And there is room for improvement in such unlikely products as clothes washers and electric ranges.

Table 2 shows what could happen if manufacturers offered and consumers purchased the most efficent appliances and lighting equipment likely to be available during the next two decades. In most cases these products are already on the market or have been tested in prototype. It is possible to reduce total appliance and lighting energy by 33% during the period 1980 to 2000 even though the population and the saturation of many appliances will increase during this period. Table 3 shows that the most efficent models are also extremely attractive investments. While it is unlikely that the market will actually move in the direction of the "technical potential" shown in Table 2, it can be seen that decisions about appliance purchases could have a significant impact on overall U.S. energy consumption. The tension between what is now being purchased and what could be purchased given a change in the behavior of consumers makes for a very uncertain future. One thing is clear--appliance technology could play as important a role as any major new energy technology during the next 20 years.

3. Foreign technology

With a few exceptions I'll discuss later, few foreign appliances are sold in the U.S. (see Table 4). In fact, with the important exception of refrigerators ~~and freezers~~, the U.S. is a net exporter of appliances. The absence of foreign competition stems in part from the fact that, until recently, the market for appliances in the U.S. differs significantly from most other markets in the industrialized world. U.S. consumers have been able, and willing, to invest more in such amenities as clothes dryers, large refrigerators, freezers, and dishwahers while these products are often not widely used in Western Europe or Japan. Table 4a shows the average amount of energy used by major appliances in the U.S., Japan, and parts of Western Europe. The relatively low consumption of foreign appliances is due in part to the higher efficiency of some classes of foreign appliances, but it is due more to the fact that foreign appliances are smaller. In the early 1970s, for example, the typical Japanese refrigerator had a volume of only about 6 cubic feet. A typical U.S. refrigerator has 17 cubic feet. European refrigerators are somewhat larger than the Japanese brands, but are still smaller than average U.S. models.

Direct marketing of foreign appliances in the U.S. would require one or more of the following: foreign manufacturers could develop products specially designed for U.S. markets; foreign markets in appliances could become more like those in the U.S.; or U.S. appliance markets could become more like European markets. Speculation on any of these issues is difficult. It does seem, however, that other industrial nations are beginning to exhibit a demand for appliances that resembles the U.S. market.

Table 5 summarizes the best refrigerators and freezers now available in the U.S., Japan, and Europe. It can be seen that the best foreign products are more efficient than the best U.S. products in virtually every category. Since foreign manufacturers typically do not make many models in the larger sizes demanded by the U.S. market, however, any competition developing in the next few years is likely to occur in the smaller product classes. It is important to notice the footnote on Table 5 warning that there is no world-wide standard for testing appliances. As a result the performance statistics may not be fully comparable. What we know of Japanese test methods, however, seems to indicate that the measured performance might improve if they used U.S. test methods.

It is also interesting to notice the rate at which Japanese products are being improved. Table 6 compares U.S. and Japanese product improvements during the last decade. It can be seen that in some areas the U.S. is making relatively rapid progress while in others, virtually no changes are occuring. The Japanese are clearly moving more rapidly than the U.S. in the categories for which we have data. They began with refrigerators less efficient than typical U.S. models in the early 1970s (in part because it is difficult to make small models highly efficient) but the average efficiency of the products they sell today is considerably better than the average efficiency of products sold in the U.S.

4. Foreign products in U.S. markets

Foreign penetration of U.S. appliance markets has thus far been limited to very specialized areas. It is difficult to identify a trend but certainly some of the products being offered have the potential for significant sales. We have discovered the following specific examples:

--Daikin Kogyo Company Ltd., a Japanese air conditioning and refrigeration manufacturer, is offering a multi-zone heat pump system through an American distributer, International Energy Systems Inc. in San Jose, California. The systems allow much more flexible control of temperatures in different parts of a home than standard heating systems. Two zone units sell for approximately $1000, 3-zone systems for $1300, and 4-5 zone systems for $2400.(5) Installation should cost approximately $150 per zone. Savings result from the fact that bedrooms need not be heated or cooled during the day and other parts of a house may not need space-conditioning for extended periods. The distributer claims that this can reduce electric consumption by 35-40% but independent tests have yet to confirm this.(6)

Several U.S. manufacturers are apparently developing similar systems but none are yet on the market.

--Commercial-scale absorption chillers manufactured by the Japanese firm Hitachi are also being marketed in the U.S. These high-efficiency, two-stage systems are well established products in Japan. In the U.S. a subsidiary of Brooklyn Union Gas (Gas Energy, Inc.) has sold approximately 28 of the units in the past year (7) . The average size sold was approximately 400 tons. The units are either directly fired by natural gas or other fuels or are used as a part of cogeneration systems. The distributer claims that at present, no U.S. manufacturer is producing comparable equipment.(8)

--Mitsubushi, the large Japanese electronics firm, has begun to sell high efficiency compressors to a number of U.S. companies manufacturing refrigerators and air-conditioners. Apparently, Mitsubishi has decided that it will be easier to sell components in U.S. markets than to compete in finished appliance products. Hitachi and Toshiba are apparently also interested in the market and have obtained U.L. certification for several compressor models. According to one major U.S. appliance manufacturer, the Japanese compressors are of high quality, they are quiet, and they are competitively priced.(9)

It is of course impossible to speculate about the marketing plans of foreign companies. A number of products are available overseas that have not been offered for sale in the U.S. For example, Toshiba has developed an efficient variable speed air-conditioner which incorporates state-of-the-art electronic controls, but has not begun to offer it in U.S. markets.(10) The Europeans and the Japanese have a number of efficienct appliances now sold exclusively in their domestic markets. These include small-volume water heaters with low standby losses and front-loading washing machines that require much less hot water per load of wash.(11) However U.S. consumers would have to be willing to sacrifice some level of amenity to consider buying such products. U.S. manufacturers are not manufacturing such products because they do not feel that there is a significant market for such devices in the U.S.

There is no easy way to estimate the competitiveness of foreign appliance products in U.S. markets. The attractiveness of foreign products will depend on price, reputation for quality, and the presence of attractive special features as well as efficiency. The U.S. market for appliances and space conditioning equipment is complex. It is difficult to sell efficient appliances in a large fraction of the market because many units are purchased by builders and other "third-parties" with no direct incentive to reduce appliance operating costs. For example, in 64% of all owner-occupied households, new space heating systems are bought by a "third-party" agent.(12) Likewise, residential water-heaters are not purchased by the individuals who will pay the energy bills in 43% of U.S. households.

In the past, the Japanese have proved extremely skillful in marketing products in the U.S. because of well-designed advertising programs and an ability to identify new marketing opportunities. Competition could well come from unexpected directions.

5. The role of government

Most industrial countries have programs to encourage the introduction of efficient residential appliances, though there is a great deal of variety. The European Common Market is developing a coordinated testing and labeling program but has yet to reach final agreement.(13) The Japanese are very concerned about the impact of a growing demand for domestic appliances and have an agressive program in the area.

The Industrial Science and Technology Agency of Japan's MITI has adopted a comprehensive program to improve the energy efficiency of Japanese industry.(14) The plan includes;

--support of basic research on energy conservation technologies
--subsidies to appliance manufacturers designed to "facilitate the earliest possible development of equipment featuring energy conservation"
--establishment of energy savings standards
--participation in international research programs
--development of an analytical base from which to evaluate measures to improve energy efficiency.

Among other things, the program subsidizes industrial research in efficient appliances and provides funding for test marketing. The government selects general areas where performance improvements seem possible at a reasonable cost, establishes "targets" for improvements based on consultation with manufacturers, and provides support to several competing companies attempting to meet the target efficiencies. The Japanese claim that the program has moved the market so rapidly that it has led to significant increases in the funds private companies are directing to research and development in appliance efficiency.(15)

Some of the efficiency targets are extremely ambitious. For example, Article 18 of the appliance laws passed in 1978 establish a 1983 target of 10.9 for the EER of the most common model of room air-conditioners sold in Japan.(16) The law calls for an overall increase in room air-conditioner performance of 17% between 1978 and 1983, and a 15% improvement for other types.

Japanese efficiency targets for refrigerators are summarized in Table 7. They call for a 20-25% improvement over 1978 efficiency-- a challenging objective given the good performance of existing models.

Partly in response to the ambitious targets, Toshiba, Mitsubishi, Hitachi, and other major appliance manufacturers in Japan increased R&D spending by 14.8% in the fiscal year ending March 31, 1981.(17) As a fraction of gross revenues, R&D investments for these firms range from 4.3% to 5.9%.

The U.S., of course, has developed standardized testing and labeling programs for most major appliances. The Department of energy sponsors a small program to support research on innovative new appliance designs. Minimum efficieny standards have been adopted by a number of states (although their fate is uncertain given the recent proposed Federal rulemaking). Several private utilities have adopted programs to encourage the purchase of efficient appliances in their service areas. The appliance program at DoE would be virtually eliminated in some of the proposals now being considered.

There is evidence, however, that previous DoE work has suceeded in accelerating the introduction of efficient appliance products. For example, a DoE program may well have prevented a major foreign penetration into the billion- dollar market for ballasts for flourescent light fixtures. Several years ago there were indications that foreign firms (Hitachi, Phillips, and others) were preparing to introduce a high-frequency ballast that could improve the efficienty of flourescent lighting by 25% or more.(18) Prompted in part by DoE research, U.S. firms developed and are introducing high-efficiency ballasts in the U.S. market. The foreign firms have thus far not attempted to compete in the U.S.

6. The U.S. industry

While less concentrated than the U.S. automobile industry, the U.S. appliance manufacturing industry is dominated by a relatively small number of large firms. Table 8 indicates that this concentration has increased during the past few years. This has occured largely because of a number of mergers and acquisitions by Raytheon (which bought Amana, Caloric Corp, Speed Queen and Modern Maid during the past 15 years), White Consolidated Industries(buying Hupp, Athens, Franklin, Kelvinator, and Philco appliance divisions as well as Westinghouse's appliance division), and United Technologies (which purchased Carrier in 1979).(19) There has been much recent speculation about whether funds invested in mergers of this kind are well spent and the future of the U.S. appliance industry should provide a good case study of this issue. It does seem, however, that the larger firms are willing to spend a much higher fraction of their revenues on research and development than their smaller competitors. The largest appliance firms invested 5.3% of their revenues in R&D (a figure that compares well with the Japanese record).(20) Medium and small firms invested only 1.0-1.8% of their receipts in research. These figures, and their Japanese equivalents, may not give an accurate picture of relative support for improved efficiency; however, since it is difficult to define how much of the research actually is directed to improving appliance efficiency.

7. Appliances as an Energy Technology

The preceeding discussion illustrated several major themes;

--appliance technology can play a major role in the U.S. energy economy. Appliances use about 8% of all U.S. energy, a fraction that could grow as other areas of the economy become more efficient.

--appliance markets could change rapidly if consumers begin to make more informed purchases

--technical changes have made many major appliances much more efficient and the potential for further improvements has not been exhausted

--foreign firms have not begun to penetrate U.S. markets in a serious way but often have superior products for sale in their own domestic markets

--foreign competion is more likely to develop if foreign appliance markets change to match U.S. tastes in appliances

--foreign firms may well choose to export licenses or components instead of complete appliances

--governmental policy overseas, particularly in Japan, seems to be contributing to the development of efficient consumer appliances.

Encouraging purchases of efficient appliances is one of the most economically attractive techniques now available for making the U.S. economy more efficient. An enormous amount can be done simply by making consumers more informed. Increased consumer interest in efficient appliances would also have the effect of increasing U.S. savings rates by encouraging individual investments in technology that can do much to make the U.S. more productive.

We have an industry that is plainly capable of matching any foreign technical development. But the situation could change rapidly. The matter deserves the attention of anyone interested in national energy policy.

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TABLE 1
INSTALLATIONS AND APPROXIMATE RETAIL VALUE OF APPLIANCES AND SPACE CONDITIONING EQUIPMENT (1980)(a)

Product	Cost per Unit (1980 $)	Installations in 1980 (10^6)	Retail Value (10^6 $)
Refrigerator/Freezer	547	5.58	3052
Freezer	353	1.49	526
Electric Water Heater	165	3.53	582
Gas Water Heater	203	3.19	648
Oil Water Heater	374	0.10	37
Electric Range	220	3.76	827
Gas Range	459	1.44	661
Electric Dryer	217	2.71	588
Gas Dryer	268	0.52	139
Room A.C.	243	4.03	979
Central A.C.	1274	2.08	2650
Gas Central Space Heat	1617	1.27	2054
Oil Central Space Heat	2592	0.25	648
TOTAL	—	29.95	13,391

(a) Source: Consumer Products Efficiency Standards Economic Analysis Document, DOE/CE-0029, U.S. Dept. of Energy, March 1982.

TABLE 2
APPROXIMATE CURRENT CONSUMPTION AND TECHNICAL POTENTIAL FOR APPLIANCE ENERGY CONSUMPTION IN THE U.S.
(in 10^{15} BTUs)

	1980	2000 "POTENTIAL"
Refrigerator/freezer	1.54	1.02
Freezer	0.52	0.42
Electric Range	0.36	0.21
Gas Range	0.35	0.21
Clothes Washer	0.06	0.07
Dishwasher	0.06	0.07
Electric Dryer	0.39	0.52
Gas Dryer	0.07	0.08
Electric Water Heater	1.42	0.77
Fuel Water Heater	1.29	0.67
Lighting	0.98	0.5
TOTAL	7.04	4.73

Source: Howard Geller, "Energy Conservation Potential for Residential Appliances", American Council for an Energy-Efficient Economy, May, 1982. see also SERI *A New Prosperity: Building a Sustainable Energy Future*, Brickhouse, 1980.

TABLE 3

EFFICIENCY AND ECONOMIC FEASIBILITY OF BEST U.S. MODELS CURRENTLY AVAILABLE

Product	Efficiency Parameter	Efficiency of Typical Model Sold in 1980(a)	Efficiency of Best Model Available in 1982(b)	Simple Payback Period for Best Model (yrs)(b)(c)	Real Internal Rate of Return for Best Model (%) (b)(c)(d)
Gas furnace (~100,000 BTU/hr)	Seasonal efficiency	0.65	0.95	4.2	30.5
Electric water heater	Overall efficiency or COP	0.78	1.70	2.8	36.8
Central air conditioner (~36,000 BTU/hr split system)	SEER	7.1	14.0	5.4	16.9
Room air conditioner (~8000 BTU/hr)	EER	6.4	11.0	6.2	15.7
Top mount refrigerator/ freezer with automatic defrost freezer (16-18 ft^3)	Energy Factor(c)	5.5	8.7	5.8	18.2
Top mount refrigerator/ freezer with manual defrost freezer (14-16 ft^3)	Energy Factor(c)	5.4	9.9	--	--

NOTES:

(a) See "Consumer Products Efficiency Standards Economic Analysis Document," DOE/CE-0029, U. Dept. of Energy, March 1982.

(b) See "Preliminary Comments on the Proposed Rulemaking for Consumer Products," American Council for an Energy-Efficient Economy, May 19, 1982.

(c) Simple payback and internal rate of return are relative to a model with the average efficiency in 1980.

(d) The real internal rate of return is the discount rate which gives the same net present value for capital and operating costs as the typical model sold in 1980. The assumptions for fuel price escalation and equipment lifetime are taken from note (a).

(e) Energy factor is the corrected volume divided by daily electricity consumption where correced volume is the refrigerated volume plus 1.63 times the freezer volume.

TABLE 4
IMPORTS AND EXPORTS OF APPLIANCES
(millions of dollars)

	1979 Shipments	exports	imports
Refrigerators	3186	43.3	100.5
Freezers	699	16.1	7.1
Room A/C	1327	171	7.3
Ranges & Ovens	1794	34.1	5.3
Clothes Dryers	969	10.7	0.39

Source: Department of Commerce

TABLE 4a
COMPARISON OF ENERGY USE IN APPLIANCES

	Energy consumption in kwh/year					Market saturation (in percent)				
	JAPAN	U.S.	U.K.	FRG	FRANCE	JAPAN	U.S.	U.K.	FRG	FRANCE
Refrigerator/freezers	626	1,730	1070	640	600	106	115	87	97	7
Refrigerators		1360		332	280	-	101	-	98	9
Freezers		1360	840	600	790	-	49	25	50	2
Television (color)	392	371	250	180*	170*	97	86	60	96*	94
Television (B+W)	119	113	320	-	-	27	101	51	-	
clothes washer	37	84	200	350	450	98	78	73	89	7
dishwasher	-	303	340	670	750	-	43	4	18	1
water heater	5191	4642	1610	1500	1500	7	96	67	39	2
air-conditioning	307	1539	-	-	-	48	56	-	-	
lighting	428	820	330	250	250	100	100	100	100	10

*average of B+W and color
Source: Energy Economic Research Institute, "International Comparison of the Structure of Household Energy Consumptior April 10, 1981. Data applies to 1979 and 1980. Oak Ridge National Laboratory

Table 5
THE WORLD'S MOST EFFICIENT REFRIGERATORS AND FREEZERS(a)

	VOLUME ft^3	ENERGY FACTOR(b)	TYPE(c)
1. Refrigerator/freezers			
a. Best U.S. models			
GE (TA14SB)	13.9	9.8	M
Amana (ESR-16E)	16.2	9.9	P
Amana (TSC-18E)	18	8.7	F
b. Best Foreign Models			
Bosch (KK 368)	12.3	15.4	M
Electrolux (TR 1281)	13.7	9.1	P
Toshiba (411)	14.4	11.5	F
2. Freezers			
a. Best U.S. models			
Kenmore (812153)	15.1	13.5	C-M
Amana (C-15B)	15	13.5	C-M
Kenmore (8221540)	15.1	12.5	U-M
Whirlpool (EV 15HK)	15.2	9.1	U-F
b. Best Foreign models			
National (NR-4502FC)	15	16.5	C-M
Husqvarna (BE-400)	14.4	14.6	C-M
Cylinda (AF-345)	10.6	9.6	U

NOTES:
(a) Ssources: manufacturers data.

(b) Energy Factor = (corrected volume)/(kwh per day), where corrected volume equals refrigerated volume plus 1.63 times freezer volume.

(c) M=manual defrost; P=partially automatic defrost; F=fully automatic defrost; C=chest type; U=upright
NOTE: nergy consumption of refrigerators and freezers is measured using different test proceedures in different countries. Therefore the energy factors of U.S. and foreign models are not directly comparable.

TABLE 6
TRENDS IN THE AVERAGE EFFICIENCY OF NEW APPLIANCES(a)

Product	Country	Efficiency Parameter	Base Year	Increase from 1972	
			1972(b)	1978(c)	1981(c)
Refrigerator/freezer	U.S.	Energy Factor	4.16	5.09 (22.4)	6.60 (58.6)
Refrigerator/freezer	Japan	Energy Factor(d)	2.92	4.98 (70.5)	9.13 (212)
Room air conditioner	U.S.	EER	6.22	6.75 (8.5)	7.34 (18.0)
Room air conditioner	Japan	EER(f)	6.66	8.99 (35.0)	10.5(e) (57.7)
Freezer	U.S.	Energy Factor	7.53	10.0 (32.8)	11.64 (54.6)
Gas furnace	U.S.	Seasonal Efficiency	.632	.636 (0.6)	—
Gas hot water heater	U.S.	Efficiency	.474	.482 (1.7)	--
Central air conditioner	U.S.	SEER	6.66	6.99 (5.0)	7.48 (12.3)

NOTES:

(a) Sources: "CPES Economic Analysis Document," U.S. Dept. of Energy, March 1982 for U.S. d and Tsuchiya, H., "Country Study: Japanese Case," paper presented at the Workshop on End-Use Focussed Global Energy Strategy, Princeton University, April 1982 for Japanese data.

(b) Base year is 1972 for all products except gas furnaces, in which case the base year is 1975, and Japanese room air conditioners, in which case the base year is 1973.

(c) Numbers in parentheses are the percentage increase in efficiency from the base year.

(d) Energy factor based on actual volume rather than corrected volume.

(e) 1980 rather than 1981.

(f) Based on Japanese test procedure.

Table 7
Japanese Target Efficiency Improvements for Refrigerators(a)

Product class	% of sales	1983 target consumption (kwh/month)(b)	1978-1983 improvement
1. Refrig/freezers			
a. top freezers			
type-1	23	25.6+0.053V	20%
type-2	25	16.9+0.114V	25%
b. side-by-side	20	21.4+0.131V	20%
2. Refrigerators	19	13.3+0.049V	8%
National average	100		20%

NOTES;

(a) Source: Energy Conservatrion Center, "Energy Conservation Handbook", September, 1980.

(b) V=volume of unit in liters.

Table 8
CONCENTRATION OF U.S. APPLIANCE MANUFACTURERS(a)
(market share of 6 largest firms)

	1973	1978
Freezers	76	97
Refrigerators	82	99
Electric Dryers	85	96
Room A/C	74	85
Central A/C	69	76
Gas Ranges/ovens	66	86

NOTES:
(a) Source: Consumer Products Efficiency Standards Economic Analysis Document, DOE/CE-0029 March, 1982 p. 69.

Mr. **Fuqua**. Thank you very much, Dr. Kelly.

Mr. Corr, you and Mr. Bailly mentioned the point that other industrialized nations provide support for research, development and demonstration, and process improvements in basic industries, not necessarily related to energy. Could you describe some of these industrial process improvement programs, who carries them out and how are they related to overall industrial policy?

Mr. **Corr**. I think that a point that Mr. Bailly made was that you actually improve energy efficiency in many projects whether they are aimed at improving energy efficiency directly or primarily at producing other productivity benefits alone. For example, in the steel industry the introduction of electric furnaces is being pursued by Sweden and West Germany and these and other technologies in the steel area, such as plasma steelmaking, not only reduce energy consumption but also improve the quality of the products that come out. So that you get these desirable benefits besides the energy savings.

To take another example, I would like to mention something that they have in the United Kingdom, a series of what are called industrial sector working parties. There are over 40 of these, one for each of the industrial sectors. They consist of joint representatives from each sector of the trade unions, the industry and the government, and they sit down and look at each industry as a whole and at what improvements need to be made not only in terms of any support for R&D but in terms of labor productivity improvements, in terms of support against foreign competition, for instance in the textiles area, and these industrial working parties produce reports each year which are considered in quite considerable detail by the government and are used as a basis for setting industrial policy. So they cover there a very broad spectrum of improvements.

Mr. **Fuqua**. Mr. Bailly.

Mr. **Bailly**. Yes, Mr. Chairman.

Jim Corr gave examples of programs that do not focus only on energy conservation. In our review, we came across several of these programs, although I should add that the focus of our review was energy conservation. Nonetheless, we found that the German Ministry of Research, for example, co-funds an extensive multiple-year program with the iron and steel companies in Germany designed to improve iron and steel technology. It has nothing to do with energy, per se. Rather, it is aimed at improving the overall technology to ensure that the process and the German steel industry remain competitive.

The United Kingdom Government has a similar type of program with British Steel, a multiple-year, cofunded program which is sponsored by the United Kingdom Department of Industry.

Sweden has a similar program aimed at the use of plasma in alloys. Many examples could be given of programs that go beyond energy conservation.

The figures I gave in my testimony on expenditures for industrial energy conservation did not include expenditures for these types of programs, which probably run into the tens of millions of dollars.

You asked about how research and development focus relates to overall industrial policy. I would like to state at the outset that I am not a student of industrial policy in all of these countries, but I am more familiar with the French system than any other. You are aware that France has a 5-year planning process in which targets are set for French industry within the context of overall economic and social development objectives. Specific policies are then defined and implemented to support these overall national objectives, which have been articulated in what is called a plan.

For example, the current administration in France believes that for France to excape from the economic doldrums in which it finds itself now, and for its industry to have any chance at all in the future, the nation—and I insist on using the word nation, rather than government, or private sector—as a whole must make an important commitment to science and technology. Therefore, the administration has set the objective of increasing nonmilitary R&D funding over the next 5 years by 17 percent a year—in constant Francs, constant money—while increasing basic R&D by 13 percent, which reinforces the point I made about a focus on near-results.

The French administration would like industry to increase R&D funding by at least 10 percent a year. Overall R&D investment objectives have been defined. Now it will sit down with industry to ensure that these objectives are met, by providing fiscal incentives and a regulatory framework which favors this type of investment.

As part of the overall industrial policy, the French economic planning process has identified several areas that offer the most potential for future markets in France and abroad. Special emphasis will be given for instance, to biotechnology, which means that those who operate in this field will get additional support. Electronics, for instance, is given a high priority, and interestingly enough, so are energy conservation and industrial conservation in general.

I hope I answered your question.

Mr. Fuqua. Thank you.

Dr. Kelly, have you looked into the question of how deeply these energy efficient Japanese and European appliances are likely to penetrate the United States or world markets?

Mr. Kelly. I tried to cover that issue briefly in the material I presented. The answer is complicated. There are a number of appliances overseas which are more efficient than anything available in the United States including major categories of appliances such as refrigerators and freezers. Take for example, air conditioners. The overlap between the domestic markets in Japan and Europe and the domestic market in the United States is at present not terribly large. If Europeans or Japanese refrigerators enter U.S. markets, it is likely that the competition will begin in the small size ranges not now widely available in the United States.

On the other hand, we discovered it is probably a mistake to look only at the import of completed products because there are many other areas affecting appliance sales where competition could take place. For example, the multizone heat pump system I mentioned is not an appliance, it is a completely installed system. Its main advantage is that even though the heat pump unit itself is not particularly efficient, it allows you to control the temperature of two, three, four, maybe five parts of your house separately., This means you can have your bedroom at one temperature and your livingroom at another. The overall efficiency of the system is impressive. This is not a product, it is a control technology and a system.

At the other end of the spectrum we found Mitsubishi and other Japanese companies have made preparations to market compressors in the United States. Only Mitsubishi is actually selling at present. These compressors are used in Japanese refrigerators and air conditioners as components. They are probably not any more efficient than the most efficient available in the United States, but the U.S. manufacturers we have talked to think they are good, reliable products, and this component could really make a major impact.

Mr. **Fuqua**. What are the governments doing to promote that?

Mr. **Kelly**. Well, of course, the Ministry of International Trade and Industry has a very strong export support program. I am sure that the other speakers here can talk to that.

But in the specific area of appliances, the appropriate Japanese Government officials sit down with the appliance manufacturers and try to decide what the appliance manufacturers can do to improve efficiency. It is a negotiating process which is mysterious to anyone looking at it from the outside.

These meetings result in a series of improvement targets for each category of appliances. For refrigerators four separate standards are established for four different classes. The Government also supports product research by subsidizing manufacturers to produce products able to meet the target efficiencies. Competing firms are supported from research and development to test marketing.

The firms themselves invest a significant amount of their own money. The firms who weren't selected as part of the research program often invest their own funds to try to keep up. The program seems to have effectively stimulated research to meet the target efficiency goals.

Mr. **Fuqua**. Do you think that has anything to do with appliance standards and the issue of whether we should abandon them, as has been the policy enunciated thus far by the Department of Energy and the new administration. Would some type of appliance standards help us be more competitive?

Mr. **Kelly**. Yes; at the moment U.S. exports of refrigerators are not very large. This is partly because our products are much larger than most of the products that are available in foreign markets. Japanese household energy use is growing very rapidly, partly because of increased appliance sales. The Japanese are concerned about the fact that Japanese consumers are beginning to look like American consumers. If that happens, there is a possibility that the United States could enter these markets more successfully.

The appliance efficiency standards that were proposed by the administration would have set a minimum efficiency threshold. Basically, they would have gotten the energy guzzlers off the market. The interesting thing about the Japanese standards is that as we understand them, they apparently operate like the automobile standards, in that the average sold unit has to meet a target. The more we thought about that approach, the more we like it. It seems to be sensible because it allows the sale of inefficient refrigerators, if the manufacture matches this sale by selling a more efficient refrigerator. The Japanese standard seems to have helped the manufacturers on the Japanese market to anticipate where markets was going to go over a 5 year period. I think the same could all work in the United States.

Mr. FUQUA. Mr. Gore?

Mr. GORE. Thank you very much, Mr. Chairman.

I appreciate the opportunity to appear here with you today.

Let me say that I was delayed at the beginning of the hearing, but I found the testimony most interesting, and I have a number of questions that I would like to quickly pursue with the witnesses on this first panel.

First of all, let me ask you, Dr. Kelly, to give me a better understanding of how quickly the export market for solar technology has advanced. Are photovoltaic arrays likely to become a major product for exporting countries?

Mr. KELLY. Well, current exports of photovoltaics have been largely limited to very specialized markets: radio repeater stations, communication devices, marker buoys, and so on. That is not a terribly large market. A major threshold is crossed when photovoltaic devices can provide competitive power to a village. Once that happens, it strikes me that the market could grow by a factor of ten rather suddenly. Exactly where that threshold is is a matter of some speculation. My personal guess is that it is when you get cells that are selling for between a dollar and $1.50 a peak watt, one tenth of the present selling price.

But reducing the cost of the cells is not enough. Photovoltaic structure systems also require support control devices, inverters and other equipment. If someone suddenly offered a cell that sold for a dollar a watt it would be hard to develop export markets rapidly since all of these ancillary devices cost too much. A lot of engineering work is required.

All of this aside, you could really go over a major point of transition by getting the price down to a dollar a peak watt and have rather dramatic sales potential. The question is what do you do between now and then?

Mr. GORE. When is that? What is your estimate of when that will occur?

Mr. KELLY. Two years ago I would have said with great confidence that by 1986 or 1987, we would at least have prototypes available at that price. Now, I guess I would have to say that it won't happen until the early nineties.

Mr. GORE. Mr. Bailly, the same question.

When do you think that threshold will be crossed?

Mr. BAILLY. I cannot answer that question. We are not photovoltaic experts.

Mr. GORE. Mr. Corr?

Mr. CORR. I would agree, more or less with what Mr. Kelly said. We at DAR did a study sometime ago of the market for photovoltaic applications in the agricultural sector of third world countries, and we estimated that the market would remain fairly small until about the 1986-88 period and then it would start to grow quite rapidly. That was on the basis that the cost goals set by JPL were met. I suppose that was on the assumption at that time that research spending would continue at those levels. So, I would say that it is the late eighties when the market starts to grow and really starts booming in the nineties.

Mr. GORE. In your testimony, Mr. Corr, you stated that only Japan of the nine countries you studied spends less on conservation as a percentage of its overall energy R&D budget than the United States. Since one generally thinks of Japan as energy conscious, can you explain this phenomenon.

Mr. CORR. I think it is partly because the figures which I was using for that were 1980 figures, based on the statistics produced by the International Energy Agency. In that particular year, according to the IEA statistics, the Japanese conservation program underwent a decline which is inexplicable.

In talking to some of the Japanese representatives of their energy organization in Washington, I think that the IEA figures are an understatement in that area, but besides that, the point is that they have continued to expand that program very rapidly with the moonlight program and the sunshine program. So, that although I don't have a figure for fiscal year 1982, I would be very surprised if the conservation area wasn't a considerably larger part of their R&D spending now.

Mr. GORE. Mr. Bailly, you give figures of $8 million for Japan in 1982 and compare it to Sweden with $40 million and the United Kingdom with $39 million. Do you have anything to add to the earlier response about why the Japanese are so low?

Mr. BAILLY. Yes. Our basis for evaluating the public sector expenditures in Japan on industrial energy conservation is the U.S. Department of Energy's Office of Industrial Programs. Therefore, to allow us to compare apples with apples when looking at expenditures, we first defined a typical program in each country, using as our basis the U.S. Department of Energy's program in the industrial sector.

For example, the Japanese think they will spend much more than $8 million this year on what they call industrial energy conservation. However, if such a program were carried out in the United States, some of the activities in the program would not fall within the realm of the mission of the Office of Industrial Programs. Such a program might be carried out with some of the fossil or solar renewable resource activities within the Department of Energy. That is one answer I can give.

The second answer I can give is that although it is only $8 million, it is $3 million more than Japan spent last year, and they plan to continue to expand their program in that area. So in relative terms, Japan is increasing its funding for industrial conservation by 50 percent in 1982 over the 1981 level.

Finally, I would like to point out that several programs in Japan are sponsored—I do not like to use the word mandated—by the Japanese Government, and are directly carried out and therefore paid for by Japanese industry. So the $8 million figure probably underestimates the total expenditure.

Mr. GORE. I was noticing that their definition of energy conservation expenditures is a little bit different than ours. They include magneto-hydrodynamics, for example, and the gas turbine.

Mr. BAILLY. We excluded such expenditures from the figure. Our total is based on the money spent in areas that the U.S. Government identifies, and funds, under DOE's Office of Industrial Programs.

Mr. **Corr**. Can I add to that, Mr. Chairman?

Mr. **Fuqua**. Yes, surely.

Mr. **Corr**. In a category which the Japanese call coal, petroleum, and petroleum substitute energy countermeasures, which is their overall conservation area, in 1981 expenditures was actually in the region of about $800 million. Now, that includes, as Mr. Bailly said, a fair amount of things that we would call fossil technology, coal, synfuels and so on, and unless one had—if I had a breakdown of that, we could go on and make a direct comparison with the overall conservation program of the United States.

The interesting thing is that figure of about $800 million is an increase of three times over the 1980 figure, and that was in 1981, and it has continued to increase since then.

Mr. **Gore**. Well, that is very interesting.

Mr. Bailly, let me ask you about a couple of statements in your testimony that confused me a little bit.

You said on page, I believe it is 3 or 4,

> Contrary to the view generally held in the U.S. market, laissez faire has been the major policy instrument of most European countries and Japan.

And then several pages on over, near the end, you say,

> Foreign companies, particularly small- and medium-sized enterprises, will continue to receive direct subsidies for their governments to go and market conservation technologies while their U.S. counterparts will have to rely strictly on their own resources.

You can see why that confuses me a little bit.

Mr. **Bailly**. Yes, but when I mentioned market laissez faire as being the primary policy instrument used by these countries, I also said that Japan, France, West Germany, Sweden, and the United Kingdom all supplement that market laissez faire with direct subsidies, information programs, training programs, and so on. They feel that it is an integral part of the market attitude. Let me illustrate.

Many of our U.S. clients are surprised by the fact, for instance, that the regulatory environment is much less restrictive for industry in these countries than it is in the United States.

Mr. **Gore**. Yes; I understand your point and the reason I bring it out in the form of a question is that I think we in this country have some real difficulty in accurately defining what the proper and efficient role of government is in this area. These two statements illustrate the fact that many of our foreign competitors have come up with a way to rely on the ever-present market forces and at the same time play an intelligent leverage role by steering or directing the natural tendency of those forces in directions of their chosing.

We seem to have an all or nothing approach here. It either has to be an impressive regulatory approach or else nothing. Right now we are at the point where the pendulum is swinging hard toward the nothing end of the spectrum, and it is pretty dumb, in my opinion. The alternative need not be an overly precise regulatory approach but can be a rather artful leveraging approach, perhaps similar to some of these successful tools used by our competitors.

For example, both you and Mr. Corr stated that the European and Japanese programs place the greatest emphasis on near term development, demonstration, and information dissemination to get new technologies quickly into the marketplace where market pressures and forces can take over. Our administration takes the attitude that that is a private sector activity and it is inappropriate for the Government to do anything like that.

Would you want to comment on that?

Mr. BAILLY. Yes; I think there is some inconsistency in the administration's position; it adopts that attitude with respect to certain energy options, mostly on the demand side, where it supports the notion of the free market as the mechanism by which technological choices should be made and companies should compete. But if you look at it from the supply side options, thinking particularly about the nuclear option, for example, the administration just as readily and as quickly provides extensive support for very short-term projects, which are more in the way of promotion of specific technologies.

I believe in the idea of free market. I am a businessman and I work essentially in the private sector, but I am also a realist. There is no such thing as a free market. The market is distorted all over the place. My interest is in insuring that U.S. industry remains competitive in the world market, so that it can keep its domestic market and retain its technological leadership in foreign markets. Whatever the administration does or doesn't do which puts U.S. industry at a competitive disadvantage with its counterparts abroad is of concern to me, and I think that relative competitiveness is the important issue at stake right now.

If someone underwrites all your R&D expenditures or, as in Germany, if you are a small business or a medium-size enterprise and can thus get up to 50 percent of your engineering, marketing, and development costs picked up by the government, you must be at a competitive advantage with any kind of small enterprise in the United States. It is just pure economics.

Mr. GORE. Mr. Corr?

Mr. CORR. I think that is correct. If these governments were forced to justify these programs with regard to, say subsidizing energy efficiency improvements of particular industrial sectors, or supporting product development, or even R&D, then I believe these other countries would be saying there is a benefit not only to individuals when a particular company has an energy audit, or even a whole industrial sector undergoes an audit, or a new product is developed, there is a benefit not only to the company but to the country as a whole in terms of reduced energy consumption or in terms of safeguarding jobs of a particular sector.

So, I think that would be the rationale.

Mr. GORE. Dr. Kelly?

Mr. KELLY. I would like to add that the United States has had difficulty recognizing that energy efficient technology is a legitimate category of energy-related technology. Why is development of an efficient refrigerator compressor not as important as development of a metal that is not embrittled by neutrons? Energy supply technologies and energy demand technologies may make almost equal contributions over the next 20 years. Yet people see the demand side as soft and something that doesn't need any intervention. In fact there are a lot of technical problems in efficiency that need to be solved.

A second problem facing energy efficiency technology is that there is an emormous amount of confusion in the marketplace about what is and isn't available. Take appliances for example: Instead of having a small number of firms make decisions as you do in decisions made about new powerplants, you have millions of people who have to make individual decisions. If you are actually going to affect appliance performance, you have to proceed in a very different way than you would to improve powerplants.

Mr. **Gore**. In other words, we need some demand siders in energy policy. Mr. Nelson?

Mr. **Nelson**. No questions.

Mr. **Gore**. Mr. Shamansky?

Mr. **Shamansky**. In your discussion about Government policy, I read an article a while back about speculative home builders, which is the way many of our houses get built.

Mr. **Gore**. They are all speculative these days.

Mr. **Shamansky**. When there is no governmental requirement that a builder put a fuel-efficient heating system in, then it pays the builder to put the least efficient one in because it will be the cheapest. Once the home buyer buys it, it is out of the hands of the initial builder. So the idea that there is no public interest in adopting national standards just flies in the face of commonsense. That is, I think, the explanation of why California, I believe, has some regulations with respect to the efficiency of heating and cooling systems. In fact, it does make a difference in the long run.

If I remember correctly, gentlemen, in "Energy Future," the Harvard Business School report, the author of the section on conservation said that on a cost-effectiveness basis that would be the cheapest way of acquiring more energy with the least disruption to our environment. Has anything happened since that book was published that would change that conclusion?

Mr. **Kelly**. I guess I would like to respond to that specific question you brought up. You are precisely right about the efficiency of heating systems. In the back of our testimony here you will see the history of efficiency of U.S. heating systems and in fact we take the specific example of gas furnaces. The efficiency of gas furnaces hasn't changed in the last 10 years. That is extraordinary given the fact the price of gas has gone up by more than a factor of two in the past 10 years in constant dollars. But the average efficiency of a gas furnace sold in the United States hasn't changed since 1972. The average efficiency of the unit sold in 1980 is 65 percent. But you can buy a gas furnace today that is 95 percent, and it is a good buy. If you bought the 95-percent efficient furnace, the internal rate of return on your investment in that furnace would be 30 percent.

Mr. **Shamansky**. In the place I have in Columbus, the furnace was put in in 1967. What efficiency would you guess that has?

Mr. **Kelly**. I would guess between 60 and 65 percent. It depends on how well you have maintained it.

Mr. **Shamansky**. So, between 60 and 65 percent. You say you could purchase one today that would achieve 95 percent?

Mr. **Kelly**. Yes.

Mr. **Shamansky**. So that is almost a 50-percent increase in the efficiency and with the cost of gas in the meantime having gone up——

Mr. **Kelly**. Almost a factor of four in current dollars. I do not know what it is in your region.

Mr. **Shamansky**. It isn't cheap.

Mr. **Kelly**. You asked why the efficiency of gas furnaces hasn't gone up from market forces. That is a complicated question. One of you've already stated the main reason. Something like 64 percent of all the furnace units that are purchased are not purchased by the person that is actually going to pay the gas bill; the purchaser therefore has very little incentive to buy an efficient product. There is a classic market defect. An information program telling the buyer how to ask intelligent questions about the furnace and some kind of a standard would help.

Mr. **Shamansky**. Is this 95 percent efficient furnace available on the American market and is it an American unit?

Mr. **Kelly**. Yes; it is sold by Lennox. Howard here has part of the latest data on this. I will let him describe it briefly.

Mr. **Shamansky**. You say it is a Lennox unit?

Mr. **Geller**. Lennox Industries makes it and it is a pulse combustion furnace.

Mr. **Shamansky**. Lennox has a location in Columbus. I think it does. Everything is Columbus oriented with me.

Do you have available the energy efficiency of the average European or Japanese furnace?

Mr. **Kelly**. We don't have this data. The Japanese use very few gas furnaces. Most Japanese homes are heated by a gadget which is an electrical equivalent of a coal brazier. It is fitted under a table. A blanket is placed on top and you sit around the table with your knees under it. Eighty percent of the Japanese houses are apparently heated entirely by these things.

Mr. **Shamansky**. I would like to comment, though, that to make comparisons with Japanese house and ours is unrealistic. They live in such incredibly small space, by our standards, that it is like a tiny box.

Mr. **Kelly**. Comparing our furnaces to Japanese furnaces.

Mr. **Shamansky**. It is not a good comparsion, is it?

Mr. **Kelly**. I do not have any data on European furnaces.

Mr. **Bailly**. I do not have the figures, but they can be obtained.

Mr. **Shamansky**. I would like to pursue the question, if I may, of the improvement in efficiency and cost to manufacture of photovoltaic cells. Is that part of our agenda today?

Mr. **Gore**. Sure.

Mr. **Shamansky**. There is a witness on that in the second panel? I will not anticipate that, then. I will defer at this point. I would like to ask this question. Can you cite to us the most successful national program to foster conservation?

Mr. **Corr**. I am afraid it would be difficult to say. I mean, for a valid comparison the figures would probably have to be based on something like a comparison of energy consumption per unit of industrial output, or per unit of GNP if you are looking at conservation over the society as a whole.

I am afraid I do not have those figures available, but I think——

Mr. SHAMANSKY. Do you have an opinion?

Mr. CORR. I know that the Japanese have cut their oil consumption by a tremendous amount very successfully over the last few years and have set themselves quite strict goals of getting their oil consumption down to 18 percent below the level before 1973.

Mr. SHAMANSKY. You say 80 percent?

Mr. CORR. No, 18 percent. Now they have done that partly by substituting other fuels, so that is not in itself an overall improvement, but I would say that they clearly have been in the forefront. The West Germans also reacted to the first major oil price increase very successfully, partly through individual actions and not necessarily through Government programs. But they, I think, spent less on oil in 1975 than in the previous year despite huge price increases. That was in the domestic sector. But overall, I think it would be difficult to pinpoint and say this particular country is clearly ahead.

Mr. BAILLY. I would like to try to answer this question. I agree with Jim that you cannot pinpoint the best program. My answer is more of a composite. I could tell you which program in each of the countries is—in my opinion—a cost-effective program. For instance, I would pursue the United Kingdom type of program, on the demonstration side. I think this type is very cost-effective, is very well understood, and is a way of publicizing some of the results for very little money. You are talking about a small amount of money that is well spent. And many of the private United Kingdom companies feel the same way.

So, I would go to the United Kingdom for the demonstration program that they have for industry. I would go to France for its industrial auditing program, which—by the way—is the only regulation affecting French industry. France has an effective auditing program which has been ongoing—on a voluntary basis—for 25 years.

Mr. SHAMANSKY. Has it been well received by those auditors?

Mr. BAILLY. Yes, sir, but they are used to it, as I said before, because they did it on a voluntary basis, and when it was voluntary, there was something like a 90-percent participation rate in this audit campaign.

Mr. SHAMANSKY. It's just part of the French scene?

Mr. BAILLY. Yes, sir, I would take the Germans' program in terms of the way they deal with their small business. They have a very good program for helping small businesses be more effective and more competitive, to save energy, to develop products, and so on. I think that this program is an excellent model for us to look at.

Finally, I would look at Japan and the way the Government is able to establish a good relationship with the private sector and work closely with the private sector and all parties interested in R&D programs to establish priorities, select projects, and so on. I would take a bit from each country and based on that, create a model which I think would be optimal.

Mr. CORR. To take another example where one country has done particularly well, is Japan again, and this is in the area of joint sponsorship of research among industry, universities, and government. They have had some very successful efforts in that area, for example in the steel industry, and I think it's particularly striking because in the late fifties and early sixties the U.S. universities were clearly among the world leaders in basic research in metallurgy.

But as the U.S. steel industry declined under increased competition, they started to cut back on their funding of university research, and, as a result, say, where there once was an ARMCO professor of metallurgy, there no longer would be.

But the Japanese Government has continued steadily to put funds into this area for over 20 years. And now a colleague of mine, who has just completed his thesis in extractive metallurgy, tells me that if you want to do a thesis in that field today, you have to know what the latest Japanese research is. They are now clearly the leaders and that has been the result of a continued steady expansion of joint government-industry support for university research.

That is a point that we have made in passing before but is worth repeating—the steadiness of support for these areas, the consistency is extremely important.

Mr. SHAMANSKY. Could I have your opinion as to——

Mr. KELLY. Could I say one thing?

Mr. SHAMANSKY. Please.

Mr. KELLY. To pick up on the national programs, there is one interesting program that you wouldn't want to adopt. This is sort of the "boo of the week" category.

Mr. SHAMANSKY. The what of the week category?

Mr. KELLY. The "boo of the week", if you want a program in which you really don't want to emulate, which provides an example of ridiculous regulations and false price signals, look at the Soviet Union and Eastern Europe. The energy productivity of those countries hasn't changed for 10 years.

If you look at the plots of energy productivity of the U.S. economy, it's improved by almost 20 percent. If you look at the same statistic over the last 10 years for the Soviet Union there is absolutely no improvement.

On the other hand, I would like to add to Mr. Bailly's list of programs to emulate. The Swedish building program has been extraordinarily successful. The link between specific programs their results is often hard to trace but the result is extremely impressive. A new building in Sweden is almost twice as efficient as the new U.S. building. That applies to residential and commercial.

Mr. SHAMANSKY. I have had the advantage of having traveled in the Soviet Union. There is very little about it I would like to emulate.

Could you cite in your opinion what would be the least intrusive program or thrust that we could adopt here? I am trying to be considerate of the sensibilities of this particular administration and still find cost-effective options.

Mr. BAILLY. If I had only $1 to spend, I would spend it on the technology development side, which I think is most important.

Mr. SHAMANSKY. And how would you do that? How would that be done?

Mr. BAILLY. I have my ideas about that.

Mr. SHAMANSKY. It would be a multiplicity of methods?

Mr. BAILLY. Yes, sir, the key thing is that it would have to be multiple year; consistency is extremely important. The program should be set for 2, 3, 4, years, whatever you decide the time frame is, and implemented in a systematic fashion.

I think that one of the major failures of past, and to some extent, of present policies on the demand side, has been the fact that industry doesn't really know what's happening. It's a continuously changing environment, unlike Japan or France, where you have a 4- or 5-year program and you can tailor your own research. You can tailor your own programs to what the government has stipulated as national policy.

I should add that the tools and policy instruments which have been used overseas are not new to the United States. Actually, a lot of them came from the United States or were first tested in the United States. We are very quick at dreaming up new policies, but also very quick at dropping them.

We came across auditing programs in the United States which are extremely well run and well managed, and could be very good information transfer programs, so I think we do not necessarily have to look abroad. I think that we must look at the types of things we have done in the past, particularly in the last 10 years; we should analyze some of those programs, perhaps revive them, and take it from there.

Mr. SHAMANSKY. Thank you.

The other gentleman?

Mr. CORR. I would think that the auditing area is an extremely important one, particularly if you can do it across whole industrial sectors. I would say that in the United States given the particular cultural and political sensibilities you would probably want it to be a voluntary program rather than mandating it.

But if you can do it across broad sectors of industry, it not only helps those industries improve their energy efficiency immediately, but also, and this is how a number of other countries use it, it pinpoints areas for further research. You then can discover exactly what are the particular points in the industrial process that are key and are the primary energy consumption areas, and so on, and then you can use that as a basis for your research programs.

Obviously, auditing has to be supplemented with information programs so that industries get to learn of the benefits.

Mr. SHAMANSKY. Doctor Kelly?

Mr. KELLY. Well, I would give a cheer for everything that the previous two people have said, and I would add the auditing program to buildings because it's another place where experimental programs in different parts of the United States have shown rather dramatic results. Federal support for these efforts has all but vanished, and it doesn't have to be terribly intrusive but there is an intellectual content in designing a good building audit which can be best done at the Federal level.

How do you do it? You take tools, you accumulate statistics on what approaches have worked and what haven't.

Mr. SHAMANSKY. Has the American Gas Association or the Edison Institute pushed a national auditing program for their customers, or their member customers, I should say?

Mr. **Kelly**. The American Gas Association has greatly increased the funding that they have made available for gas appliance R&D. In fact, this 95 percent efficient furnace I talked about was a direct product of some of their research investments.

Mr. **Gore**. Along with DOE?

Mr. **Kelly**. Along with DOE. But the amount of work that they and the electric companies have actually put into developing and designing effective audit programs has been quite limited. There was some expectation that it might increase because the Federal program has almost vanished. But if it's happened, at least I am not aware of it.

Mr. **Shamansky**. Thank you very much, Mr. Chairman.

Mr. **Gore**. Thank you very much.

Mr. Bailly, you mentioned a second ago that you would have an American effort over several years, and you note in your testimony that the objectives and budgets generally cover several years, talking about the management of foreign industrial conservation programs, and you note further that "industry participates generally through trade associations in the definition of RD&D programs."

How could this kind of approach be incorporated into U.S. programs, given our annual budget process and antitrust laws and the like?

Mr. **Bailly**. I am not an expert on the congressional process. The whole appropriations process seems rather Byzantine to me.

Mr. **Gore**. You mean it seems complicated?

Mr. **Bailly**. From the outside it looks like it.

Mr. **Gore**. You just have to get used to it. I am just kidding; of course it is.

Mr. **Bailly**. It seems to me, on the other hand, that where there is the will, Congress seems able to create multiple-year programs by removing those programs from the normal budgetary process. What comes to mind is the Synfuels Corp.

If you can do it for the supply side, I am sure you could come up with an energy productivity corporation or something of that nature that would be funded on a multiple-year basis and would be removed from the day-to-day or year-to-year cycle of budget appropriation and authorization.

I would be more than happy to work with Members of the Congress and their staff to come up with implementation of ideas, because I am sure it can be done.

Mr. **Gore**. Let me check with some of my minority colleagues before we go too far down that road, but I think that is a very creative suggestion.

You also state that the European and Japanese programs are heavily oriented toward small- and medium-sized enterprises and generally cost shared with industry. You would also recommend those characteristics for the U.S. effort?

Mr. **Bailly**. Definitely. The absence of these features has been one of the mistakes of conservation R&D programs in the past. Large multinational companies don't need the help of the Government. What they need is a consistent framework so that they can plan properly.

The situation is quite different with respect to small business and medium size enterprises, because they are generally the least able to underwrite the type of technical and market risks which are inherent in the development of new technologies. And the risks are very often so great in relation to the net worth of these companies that productive technology or R&D planning under such uncertainty very quickly becomes gambling.

So, whatever is done in the area of industrial conservation, I would give more emphasis to small- and medium-size business.

Cost sharing is an important aspect. The U.S. attitude about everything has always been what I call the big bank approach, which is thinking that money can solve everything and that by pouring $1 billion into conservation it will happen. That is not the case.

I think we have to be much more concerned about the return on Government investment, and one way to do it is by putting the companies on the line. Before any sensible company split the funding of an R&D project with the Government, it would be careful to insure that what it was investing in had some commercial potential.

When the Government pays 100 percent of the R&D, the company looks at the Government simply as another source of funds to cover overhead and whatever. So, I do not advocate 100 percent support of research and development efforts by the Government except in some very basic types of research.

Mr. **Gore**. That is very interesting.

Mr. Corr, you note that only a small amount of foreign R&D money is allocated through competitive solicitation. Why is that true and what are the advantages and disadvantages of that approach?

Mr. **Corr**. Well, the way the process works is, for example, in the United Kingdom, the government undertakes to provide funds for a program in a certain area and then industry submits possible projects for funding, and those are selected basically on the technical merits—for example potential energy savings—or on the benefits that they will offer in terms of possible export potential, possible job preservation and so on. And so it is not that the government come up with a particular idea and says we want a free-for-all of proposals in this one area. They are able to select a whole list of projects for funding, a list based on the merits of the individual proposals as they are submitted from industry. In other words, it is industry's ideas for projects that are given priority.

Mr. **Gore**. Dr. Kelly, do you believe that the extremely rapid improvements in the Japanese market result solely from the government's mandates and support? How would you analyze it?

Mr. **Kelly**. Certainly not. What they do result from is a very effective technique for coordinated government work and private investment. They are probably the best example. Whether their approach is reproducible in any other culture is another issue. But certainly the cooperation between government programs and private sector investments is extremely close.

Mr. **Gore**. Well, I hope we can figure out a way to keep from just bumping along, going from one extreme to another, from big awkward, massive, stifling approaches to chaos and nothing. It seems like we should learn some of the lessons that you all have very eloquently described for us.

I want to thank all of you for a tremendous contribution to this hearing. Thank you very much.

We are going to go to the next panel because of our time constraints. We could stay with you asking questions for some time, but we have run way overtime.

Thank you very much for your contribution today.

Mr. Corr. Thank you.

Mr. Gore. Our next panel is Dr. Robert Ferber, manager, Collector Research and Development, Photovoltaics TD&A Lead Center, Jet Propulsion Laboratory, and Todd Bartlem, research associate, International Institute for Environment and Development here in Washington.

Gentlemen, I want to welcome both of you.

Without objection, the entire texts of your prepared statements will go in the record in full at this point.

Dr. Ferber, we will start with you.

Welcome, and please proceed with either a summary or a full presentation, however you see fit.

[The biographical sketch of Dr. Ferber follows:]

BIOGRAPHIC SKETCH

Dr. Robert R. Ferber

Place of Birth: New Eagle, PA, June 11, 1935

Education:
B.S. in EE, 1958, University of Pittsburgh
M.S. in EE, 1966, Carnegie Institute of Technology
Ph.D. in EE, 1967, Carnegie-Mellon University

Employment:

1954 - 1958	WRS Motion Picture Laboratory (Manager - Engineering Department)
1958 -1977	Westinghouse Electric Corp. (Radiation Effects and Energy Technology Research & Research Project Management)
1977 - Present	Jet Propulsion Laboratory (Solar Power Generation Systems Research) (Present title: Manager, Collector Research & Development Subprogram, Photovoltaics TD&A Lead Center)

STATEMENTS OF ROBERT R. FERBER, MANAGER, COLLECTOR RESEARCH AND DEVELOPMENT, PHOTOVOLTAICS TD&A LEAD CENTER, JET PROPULSION LABORATORY, PASADENA, CALIF., ACCOMPANIED BY JAMES EVANS, MANAGER OF THE JPL PHOTOVOLTAIC TECHNOLOGY DEVELOPMENT AND APPLICATIONS CENTER; TODD BARTLEM, RESEARCH ASSOCIATE, INTERNATIONAL INSTITUTE FOR ENVIRONMENT AND DEVELOPMENT

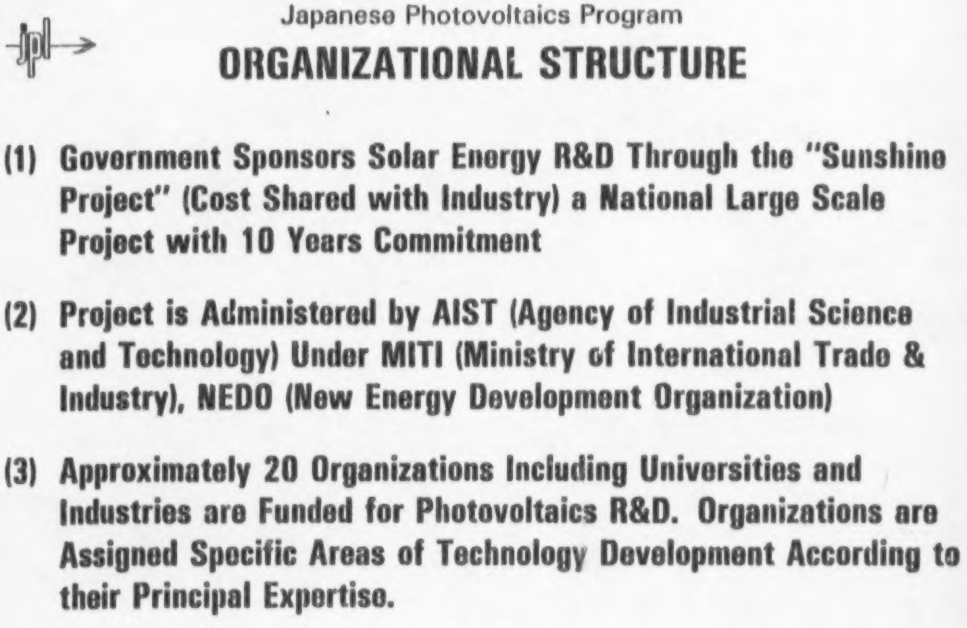
Mr. FERBER. Thank you, Mr. Gore. I would like to thank you today for the opportunity to appear before the joint subcommittees to discuss the Japanese and the European photovoltaic activities.

I am the manager of the Photovoltaics Collector Research and Development Subprogram at the Jet Propulsion Laboratory Technology Development and Applications Lead Center, which is the program coordination and management staff organization for most of the U.S. photovoltaics program.

One of the activities of my subprogram is the following of foreign photovoltaic program activities, and today, with your permission, I would like to summarize my written testimony briefly with a Vu-Graph presentation that will touch on both the Japanese and the European photovoltaic programs.

I would like to introduce Jim Evans, the manager of the JPL Photovoltaic Technology Development and Applications Lead Center, who is at the Vu-Graph machine, and I ask him to join me at the table after the Vu-Graph presentation.

I will discuss briefly the government and industry organizational structures in the areas of Japan and Europe, the R&D program resources and the technology status in materials, cells, modules, and in systems.



Japanese Photovoltaics Program

ORGANIZATIONAL STRUCTURE

(1) Government Sponsors Solar Energy R&D Through the "Sunshine Project" (Cost Shared with Industry) a National Large Scale Project with 10 Years Commitment

(2) Project is Administered by AIST (Agency of Industrial Science and Technology) Under MITI (Ministry of International Trade & Industry), NEDO (New Energy Development Organization)

(3) Approximately 20 Organizations Including Universities and Industries are Funded for Photovoltaics R&D. Organizations are Assigned Specific Areas of Technology Development According to their Principal Expertise.

FIGURE 1

Starting now with the Japanese program [fig. 1], the government sponsors solar energy R&D through the Sunshine project. The project is administered by the Agency of Industrial Science and Technology, under the Ministry of International Trade and Industries, New Energy Development Organization.

Approximately 20 different organizations, including universities and various industry organizations, are funded for photovoltaics R&D, and, unlike the U.S. program, the organizations are assigned specific areas of technology development according to their principal expertise.

Japanese Photovoltaics Program

R&D PROGRAM RESOURCES

(1) **Government Supplies Funds for Capital Equipment and Expendables, Capital Equipment is Retained by the Industry**

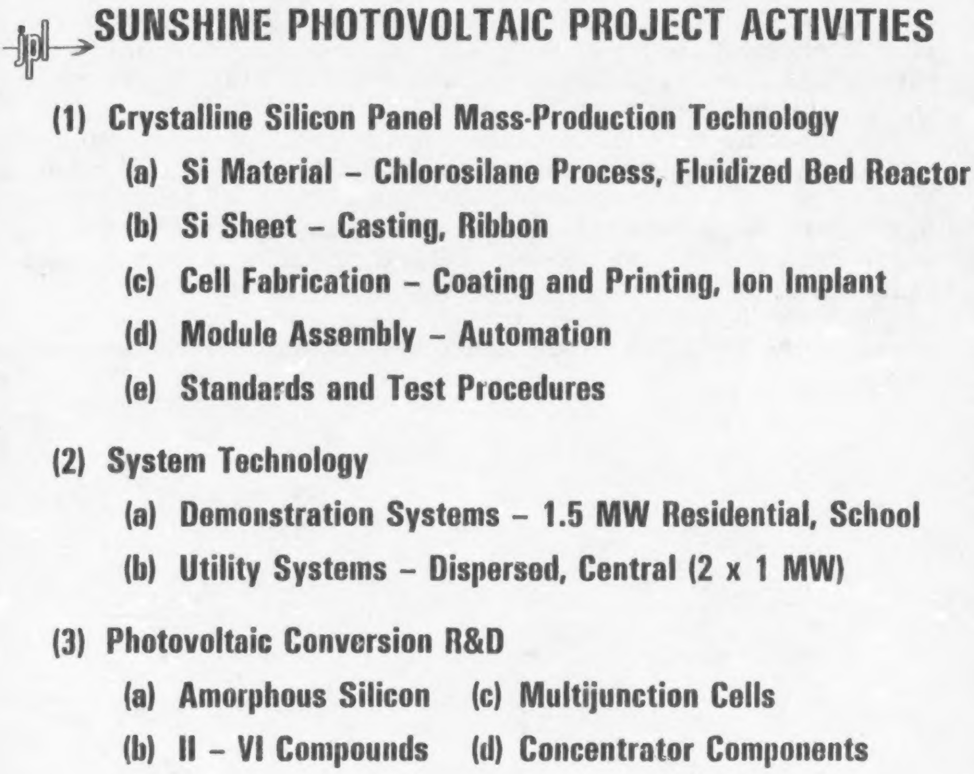
(2) **Industrial Firms Provide Cost Sharing for Labor, Overhead and Some Plant Facilities**

GOVERNMENT INVESTMENT

	1980	1981	1982
Si Photovoltaic Module Res and System Tech	5.7	18.7	22.0
Amorphous Silicon R&D	2.0	5.7	5.8
Other Material R&D	4.2	1.0	1.2
Total (Millions of $ - 230Y = 1$)	11.9	25.4	29.0

FIGURE 2

The Japanese photovoltaics program R&D resources [fig 2.] are broken into three project areas. The first and the largest is the Silicon Photovoltaic Module, Research and System Technology Activities. For 1982, this ia a $22 million effort. Next is the Amorphous Silicon Research and Development activity at $5.8 million, and then Other Material R&D activities at $1.2 million, bringing the total to $29 million for the Japanese fiscal year 1982 program. The Japanese fiscal year runs April 1982 through March 1983. It's 6 months out of phase with the U.S. fiscal year.



SUNSHINE PHOTOVOLTAIC PROJECT ACTIVITIES

(1) Crystalline Silicon Panel Mass-Production Technology
  (a) Si Material – Chlorosilane Process, Fluidized Bed Reactor
  (b) Si Sheet – Casting, Ribbon
  (c) Cell Fabrication – Coating and Printing, Ion Implant
  (d) Module Assembly – Automation
  (e) Standards and Test Procedures

(2) System Technology
  (a) Demonstration Systems – 1.5 MW Residential, School
  (b) Utility Systems – Dispersed, Central (2 x 1 MW)

(3) Photovoltaic Conversion R&D
  (a) Amorphous Silicon (c) Multijunction Cells
  (b) II – VI Compounds (d) Concentrator Components

FIGURE 3

Looking at the three photovoltaic project areas in Japan [fig. 3], the crystalline silicon mass production project, which is their technology development activity, is the largest of the three. This project is structured with activities loosely paralleling those of the U.S. flat plate solar array project at JPL. In other words, they have studied our program and built upon it using very, very similar structure.

This includes silicon material activities. The Japanese are developing advanced chlorosilane processes and fluidized bed reactors for silicon refining. It includes silicon sheet casting and ribbon production. Cell fabrication includes various coating, printing, and ion implantation processes that can be easily automated and performed at very low cost. In module assembly they stress automation. Standards and test procedures are also a major part of the project activity, just as in U.S. structured program.

The system technology project in Japan includes a number of demonstration systems which include 1.5 megawatts of residential, school and industrial installations, plus utility systems for dispersed and for centralized applications.

Going on to the Japanese advanced material R&D activities, they are concentrating on amorphous silicon activities with other small activities in areas such as cadmium sulfide, multijunction cells and concentrator components. If we look now at the market projection situation in U.S. photovoltaic program and the Japanese photovoltaic program plans, both were originally structured to develop and industry capable of producing 3 gigawatts or 3,000 megawatts per year of photovoltaic products by 1990 using crystalline silicon cells [fig. 4] The Japanese program continues to have this target while the U.S. target seems to be slipping.

The Japanese program also has a target of up to 1 gigawatt per year of amorphous silicon production by 1990. The actual U.S. production history now is somewhat lower than the DOE program projections. If the present rate of U.S. production increase continues, which has been varying between 1.4 and 1.8 factor of increase per year, the Japanese photovoltaic output could eclipse the U.S. production well before 1990. So far, the Japanese industry is on or ahead of the projected production schedule that I have shown in Figure 4.

PHOTOVOLTAIC ARRAY PRODUCTION VOLUME COMPARISON

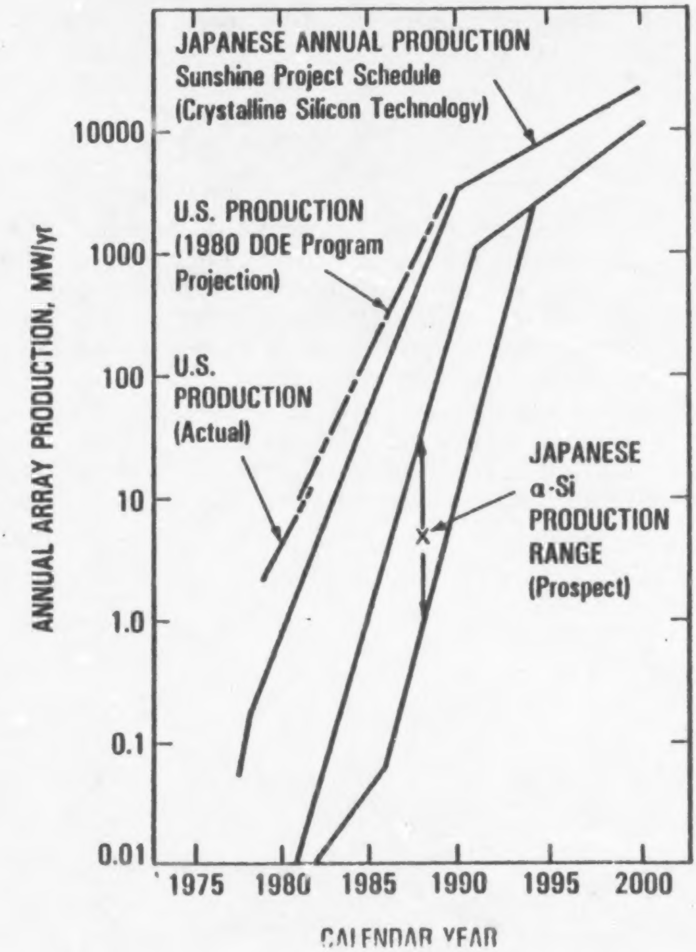


FIGURE 4

This is evidenced by a new automated photovoltaic cell plant, that has just been put on line by Sharp Corp. capable of 2 megawatts a year of production with three employees operating the plant.

Mr. SHAMANSKY. Excuse me; with how many employees operating the facility?

Mr. FERBER. Three people sitting in front of video screens monitoring the operation of the plant, and it produces 2 megawatts per year.

Mr. SHAMANSKY. That's pretty good efficiency, isn't it?

Mr. FERBER. It's certainly good utilization of manpower.

Mr. SHAMANSKY. Well, how does that compare to the best U.S. plants?

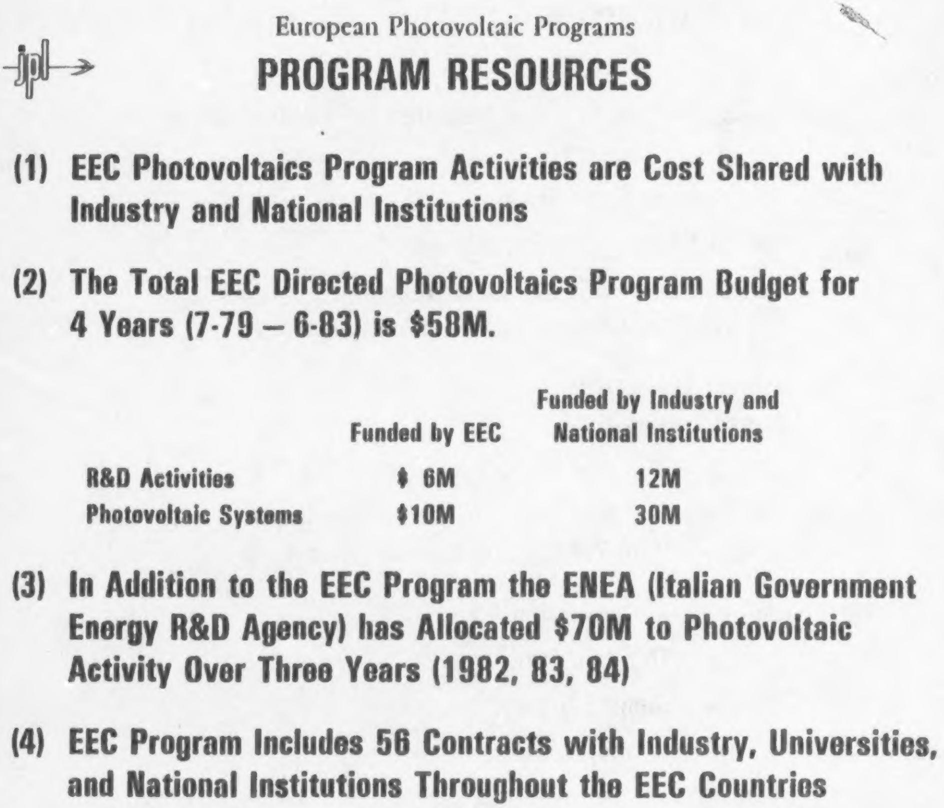
Mr. **Ferber**. I don't have very good employee data for the cell production portion of any of the U.S. plants, because most of the U.S. plants are more vertically integrated than just the cell production, but I would estimate it's perhaps a factor of 10 less than we would expect as typical in U.S. plants right now.

Mr. **Shamansky**. Thank you.

Mr. **Ferber**. Another example of this automation work is the new Sanyo amorphous silicon plant that has just begun operating. This plant is now producing 400 kilowatts a year of amorphous silicon modules for calculators and consumer products and has the capability for expanding rapidly into power devices. This one plant alone puts Japan above their target for this time for amorphous silicon production.

I would like to turn now to the European photovoltaics program. In Europe, photovoltaics R&D and photovoltaic prototype systems are administered by the Commission of European Communities [EEC], which is a branch of the Common Market. The program is based on competitive contracting with industry somewhat similar to the way the U.S. program has operated.

Many member governments have their own agencies that also administer funds for photovoltaic program activities and other speakers this morning have alluded to some of these. A notable example is the Italian National Energy R&D Organization [ENEA] in Italy.



European Photovoltaic Programs

PROGRAM RESOURCES

(1) **EEC Photovoltaics Program Activities are Cost Shared with Industry and National Institutions**

(2) **The Total EEC Directed Photovoltaics Program Budget for 4 Years (7-79 – 6-83) is $58M.**

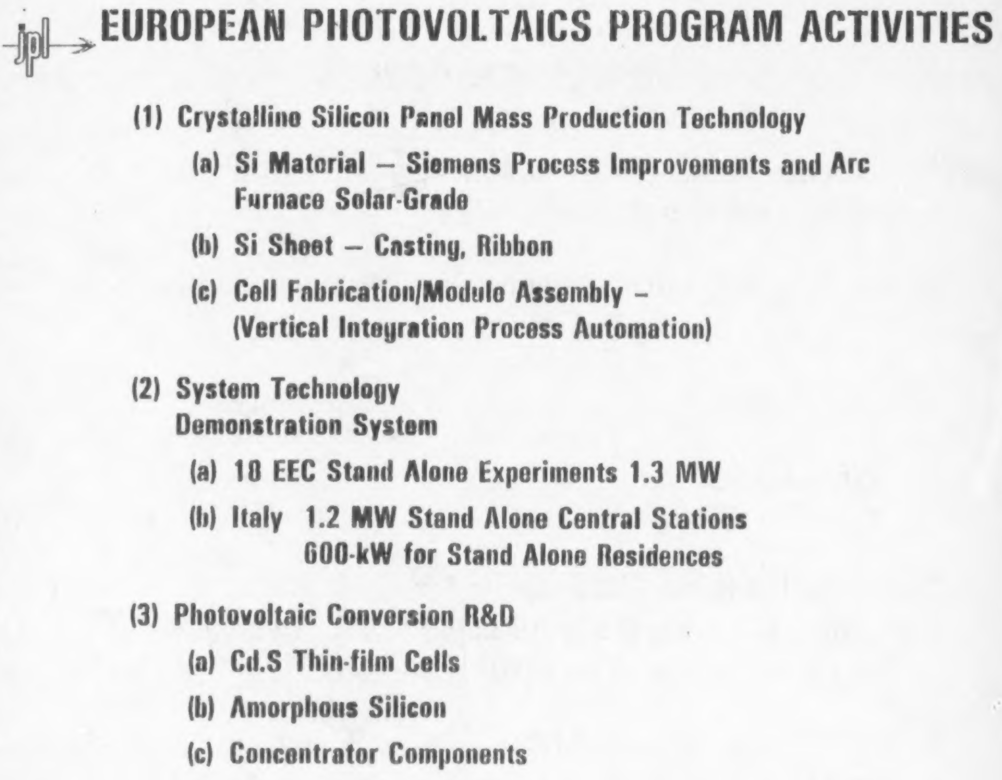
	Funded by EEC	Funded by Industry and National Institutions
R&D Activities	$ 6M	12M
Photovoltaic Systems	$10M	30M

(3) **In Addition to the EEC Program the ENEA (Italian Government Energy R&D Agency) has Allocated $70M to Photovoltaic Activity Over Three Years (1982, 83, 84)**

(4) **EEC Program Includes 56 Contracts with Industry, Universities, and National Institutions Throughout the EEC Countries**

FIGURE 5

If we look now at the European photovoltaic program resources as showing in Figure 5, the photovoltaic R&D activities funded by EEC total $18 million over a 4-year period, while the photovoltaic systems activities are budgeted at $40 million over that same period. Here we can see that the applications are receiving more than twice that being spent on R&D activities. As I mentioned a moment ago, in addition to the EEC program activities, the ENEA has allocated $70 million to photovoltaic activity over the next 3 years, 1982, 1983, and 1984. This program includes research, technology development and applications experiments, again pretty much patterned after the original program structure we had for flat plate technology development in the U.S. program.



EUROPEAN PHOTOVOLTAICS PROGRAM ACTIVITIES

(1) Crystalline Silicon Panel Mass Production Technology
  (a) Si Material – Siemens Process Improvements and Arc Furnace Solar-Grade
  (b) Si Sheet – Casting, Ribbon
  (c) Cell Fabrication/Module Assembly – (Vertical Integration Process Automation)

(2) System Technology
Demonstration System
  (a) 18 EEC Stand Alone Experiments 1.3 MW
  (b) Italy 1.2 MW Stand Alone Central Stations
  600-kW for Stand Alone Residences

(3) Photovoltaic Conversion R&D
  (a) Cd.S Thin-film Cells
  (b) Amorphous Silicon
  (c) Concentrator Components

FIGURE 6

The European economic program activities can, like the Japanese, be grouped into several project activities as listed in Figure 6. The first of these would be the crystalline silicon panel mass production technology activities and they again parallel the U.S. photovoltaic program flat plate solar array project as it was originally structured, not the way it is now.

It includes silicon material work on the Siemens process improvement and also on arc-furnace solar grade silicon. In Europe this is a significant difference from the rest of the world's programs. They are aiming largely at what we call a solar grade silicon refining process, which will produce somewhat lower module efficiencies than can be achieved if we use full electronic grade silicon in making the solar cells.

They also have silicon sheet activities, casting and ribbon and cell modification and module assembly and this tests process automation, an area that is being rapidly phased down in our U.S. program.

The next major area of activity is the system technology activities, and these activities are centered about a number of demonstration systems. The EEC is sponsoring 18 or perhaps 19 stand-alone experiments which total 1.3 megawatts. Those are being fielded over the next year or so.

In addition, in Italy, the largest projects are a 1.2 megawatt stand-alone central station experiment, larger than any other in the world that I know of, and 600 kilowatts of stand-alone installations for stand-alone systems for residences in Italy.

Advanced photovoltaic R&D activities in the European program include work on cadmium sulfide related thin film cells, on amorphous silicon and on concentrator components. I might add that the concentrator activities in Europe are relatively small compared to the U.S. DOE photovoltaic activity in this area.

An estimate of the foreign photovoltaic export sales shows that Japan and the European countries had a total of less than 1 megawatt of export sales last year, while the U.S. industry exported about 3 megawatts, out of a total of 5 megawatts of flat plate photovoltaic module production. Clearly, the United States now leads the foreign competition in export sales, but the European and the Japanese exports are expected to expand rapidly.

In summary, both the Japanese and the European resources for photovoltaic programs are now quite significant and are expected to increase in the future, while the U.S. program activity is currently trending downward rather rapidly. The majority of the foreign R&D funds are being spent in crystalline silicon development technology and in systems application experience. Europeans expect significant near-term domestic market and export markets of remote stand-alone systems and their programs are structured largely to support this. One thing I might mention is that two of our speakers earlier today mentioned things related to long-term program commitments, and most of the European and Japanese activities do have multiyear program commitments in a somewhat different structure than the U.S. program. The near-term Japanese photovoltaic domestic and export markets are largely in consumer products and remote stand-alone applications, while the Europeans are driving strongly toward the near-term, stand-alone markets.

In closing, both the European and the Japanese photovoltaic long-range programs are for grid connected systems for both domestic and export markets. They have the potential of capturing even the large future U.S. domestic market if the U.S. industry doesn't maintain the lead with respect to photovoltaic technology.

I would like to thank you very much for the opportunity to appear here today to present this testimony.

We at Jet Propulsion Laboratory are proud that we have been selected by DOE to play an important role in this program, and we are hopeful that the photovoltaic program will be able to continue to aggressively pursue its goals with the U.S. industry.

Thank you.

[The prepared statement of Mr. Ferber follows:]

STATUS OF FOREIGN PHOTOVOLTAIC R&D, MANUFACTURING, AND MARKETS

R. R. Ferber, Ph. D.
Jet Propulsion Laboratory

INTRODUCTION

Mr. Chairman, members of the Committee, I am Dr. Robert R. Ferber, Manager of the Photovoltaics Collector Research and Development Subprogram at the Jet Propulsion Laboratory Technology Development and Application Lead Center, sponsored by the DOE Photovoltaics Program.

I have the honor of presenting to you a brief overview of the status of Foreign Photovoltaic Research and Development, Manufacturing and Markets, at the request of Dr. Eugene Frankel. I have prepared written testimony, and with your permission, my presentation today will address the highlights of the written testimony.

At the present, the United States has a significant lead on the rest of the world in photovoltaics (PV), both in technology and in production. Last year, the U.S. flat-plate PV producers sold about 5.3MW of products with about 65% being exported. Concentrator deliveries during the same period approached 1MW. U.S. PV manufacturers have experienced a market growth factor of 60 to 80% per year and this market growth trend is projected to continue. During the same 1981 period, all foreign PV manufacturers sold less than 2MW of flat-plate module product. The U.S. commercial product technology is based on single and polycrystalline ingot silicon. Most foreign PV product sales have also been based on crystalline silicon, but Japan is now also marketing thin film amorphous silicon (αSi) modules in consumer products such as calculators.

The present U.S. lead in PV can, in large part, be ascribed to the very effective U.S. PV R&D Program over the period since 1973 which has been carried out in cooperation with and through industry. The remainder of the world has also recognized the potential value of PV power systems to provide an economic alternative to conventional generation. As a result, major PV technology programs have been mounted both in Japan and in Europe.

Both the Japanese and the European PV Programs, though smaller in scope, are modeled in large part after the U. S. Program and both recognize and build on the U. S. technology base. The Japanese PV Program began in 1974 as a part of their Sunshine Project. The principal PV programmatic work in Europe began in 1975 and is carried out for the various member states under European Economic Community (EEC) sponsorship. Many individual countries also have their own PV programmatic activities which supplement the EEC PV Program.

The Japanese PV Program is administered somewhat differently with industry than in the U.S. Individual companies, universities, or laboratories have been assigned overall responsibility for technology development in a specific area, such as low cost silicon refining, silicon sheet and cell formation, and encapsulation. This technology is then expected to be shared in the future to allow vertical integration within companies as appropriate. The EEC PV Program, on the other hand, is administered more like the U. S. Program with competitive contracting to industry for specific technology development activities.

This testimony will briefly overview the extensive and growing Japanese and European PV activities.

THE JAPANESE PV PROGRAM

In 1974 the Japanese photovoltaic R&D program became a part of the national project designated as the Sunshine Project, which funds most government sponsored energy related R&D work in Japan except for nuclear activities.

The Sunshine Project is administered by its headquarters in the Agency of Industrial Science and Technology under the Ministry of International Trade and Industry (MITI). The project funding (see Table 1) has been increasing steadily, especially in the PV part of the project. The FY'81 (April 1981 - March 1982) funding was $25.4M (at 230 yen/dollar) for the PV R&D according to the Sunshine Project Report "On the Progress of the Sunshine Project", February 1981, published by MITI (written in Japanese). The FY'82 figure is $29M (Japanese FY'82 started in April 1982) and is one of the few areas of FY'82 budget allowed an increase. The project funds are for capital equipment, expendables, and a part of the direct labor. The labor costs for work performed by Japanese National Laboratories are not included in Sunshine Project funding and are borne by the parent organization.

Table 1. PV PROJECT FUNDING IN SUNSHINE PROJECT
(based on 230 Y = 1$)

	FISCAL YEAR $M		
	1980	1981	1982
SILICON PV MODULE RESEARCH & SYSTEM TECH	5.7	18.7	22.0
AMORPHOUS SILICON R&D	2.0	5.7	5.8
OTHER MATERIAL R&D	4.2	1.0	1.2
TOTAL	11.9	25.4	29.0

In industry, much of the labor cost is borne by the companies; the project allows some labor costs directly expended for the project at the government-assigned labor rate. Consequently, much of the labor cost is paid directly by industry.

The Japanese PV program has organizational, structural, and technology development activities very similar to those in the US PV Multi-Year Program Plan. Their goal is to produce low cost PV products for widespread grid competitive power applications in 1986, or shortly thereafter.

Approximately 14 companies and 6 universities are involved in the Sunshine Project. Universities are mainly involved in PV device physics research, and companies are performing production-related development. The development work, which is managed by the NEDO office, is structured very closely to the Jet Propulsion Laboratory Flat-Plate Solar Array Project (JPL/FSA) work, starting with the silicon material task and ending with the module assembly task. The systems work, including demonstrations, is performed jointly between electric power companies, construction companies and module manufacturers. Approximately 75% of the Sunshine Project funds are assigned for the module mass production technology development and the system development. The remaining 25% goes into thin-film R&D, such as the well-publicized work on amorphous silicon.

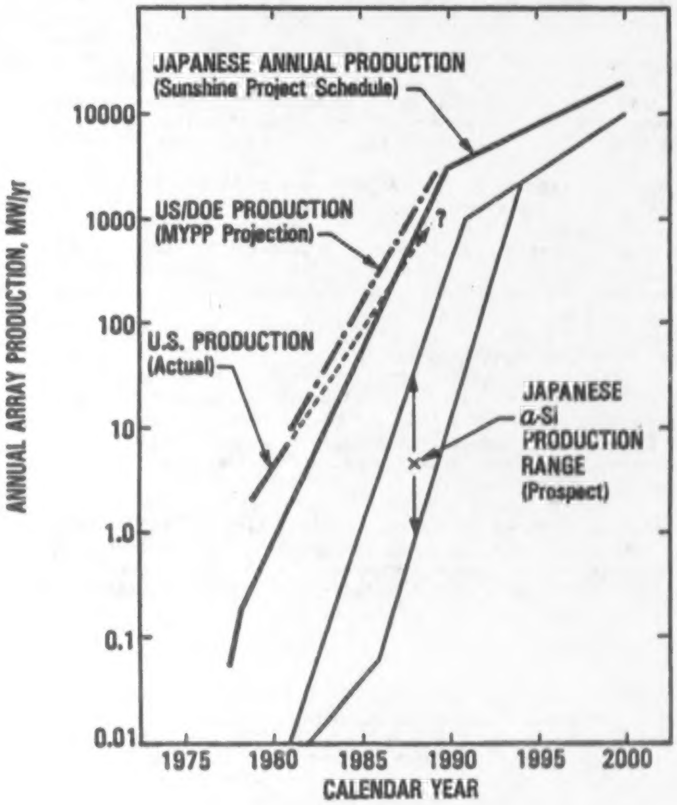
The Japanese PV technology development strategy is based on best use of the U.S. developed silicon technologies for the development of viable crystalline silicon mass production capability, and R&D to make Japan a leader in amorphous silicon cell technology for future pay off. As it was shown in the PV project funds table, amorphous silicon (a-Si) solar cell research received $5.7M in 1981 and is receiving $5.8M in 1982 from the Sunshine Project. The Ministry of Education is also funding amorphous silicon research at $1M/year for three years in addition to the Sunshine Project funding. The total a-Si funds at $6.8M are 23% of the total Sunshine Project PV funding and 85% of the basic materials PV research funds. Dr. Hamakawa, of Osaka University, reported an efficiency of 8.5% with a small area (0.033 cm^2) a-SiC/a-Si (p-i-n), and Sanyo produced a similar type of cell but with a large area (100 cm^2) having an efficiency of 5.8%. Medium-sized (approximately $1cm^2$) cells using n-i-p structure have produced efficiencies of about 7.8%. An application experiment using amorphous silicon cell modules has been operating since March 1981 at the Sanyo Company president's house which incorporates 2kW of solar panels.

Japanese companies are now busily expanding their production volumes according to the Sunshine Project schedule which calls for a 10MW per year production in about two years (see Figure 1). The current leading manufacturers are Sharp Co. with ingot silicon, and Japan Solar Energy Co. with EFG ribbon. The total 1981 production capability including several other companies is estimated at a megawatt per year. The actual 1981 production was somewhat smaller. Sharp announced last month the operation of a new automated crystalline silicon solar cell manufacturing plant which greatly expands the Japanese production capacity. This plant apparently is operated by three employees, largely monitoring computerized, line-status readout displays. This plant can produce 250 four-inch cells per hour for an annual (3 shift operation) production capacity of 2.5MW. This is an example of the fact that the entire Japanese program is aimed at large-volume, low-cost, automated production.

Sanyo has recently announced the completion and operation of a new $50M plant to produce amorphous silicon PV modules. The plant is presently producing

Figure 1 -

ARRAY PRODUCTION VOLUME COMPARISON



about one million small calculator PV modules per month (approximately 400kW/year) utilizing only one fourth of the plant. The remainder of the plant is planned to be used for future power module manufacturing. This plant exemplifies the Japanese market development philosophy of technology penetration initially in domestic and export consumer products and gradually expanding into the central electric power generation marketplace. Sanyo's corporate decision to move ahead with amorphous silicon solar cells reflects the Sunshine Project's research thrust toward an improvement of amorphous solar cell performance.

Initial PV markets are aimed at remote, stand-alone applications, such as communications, corrosion protection, and power for consumer products such as calculators, radios, and TV. As PV production costs decrease, expanding domestic and export markets for residential and other grid connected applications are expected to dominate by the late 1980's.

At present, Japanese PV exports are not significant in comparision with U.S. exports partly because of the present high cost of silicon in Japan. Also, a lack of Japanese experience with modules and systems at the array level is evident. In contrast, Japanese experience in consumer electronics that utilize relatively small PV modules is worthy of note. Companies producing and marketing such modules are rapidly acquiring mass production techniques, field data and consumer acceptance.

In general, however, application experiments with photovoltaic systems are just beginning in Japan. One notable application project is the scheduled 1982 completion of a 200 kW crystalline silicon system implemented jointly by Hitachi and Nippon Electric Company (NEC). Other large-scale system experiments are beginning to appear in the Japanese Program including residential, commercial, and 1MW central station experiments either now in planning or underway (see appendices).

Systems work including performance and cost optimization has had a lower priority in the Sunshine Project in comparison with the module technology development. In addition, the power conditioning electronics appear to be viewed in Japan as readily developable, requiring minimal development time and effort.

THE EUROPEAN PV PROGRAM

The European Economic Community (EEC), consisting of Belgium, Denmark, Federal Republic of Germany, France, Great Britain, Greece, Ireland, Italy, the Netherlands, and Switzerland, have a photovoltaic technology development program similar in some respects to, but smaller than, the U.S. PV Program. The EEC PV program funds research and technology development activities, which are felt to be important for the continued development of the European industry and they operate a PV module and array test facility at the Commission's Joint Research Center at Ispra, Italy. The largest portion of program funds are allocated for a series of 18 or possibly 19 application experiments now being designed and fielded. At least one of these application experiments will be fielded in each of the EEC member nations.

The European PV program thrust is somewhat different than that of the U.S., which is aimed primarily at early and extensive U.S. grid-connected power. The European program recognizes the long term need for PV energy displacement in Europe with a goal of 0.5% photovoltaic energy generation by the year 2000. The nearer-term thrust, however, is to develop a European industry serving the export market for stand-alone and village power systems. Thus, the Europeans are not driving towards truly low-cost module technology as rapidly as are the U.S. and Japanese PV Programs. As a result, much of the present European industrial activity focuses on cast polysilicon ingot processes with a "solar grade", arc-furnace-refined silicon feed stock. Such processes are not likely to yield the higher efficiency modules, which appear to be necessary for grid-connected economic viability in the U.S. Concentrator technology activity is very small in Europe at this time.

The EEC has projected a European market for PV by the year 2000 to be between 650 and 1150 MWp per year with an export market to developing countries being much larger. A recent EEC world photovoltaic market forecast is shown in Table 2. Note that the above EEC low side figure for the European market is higher than that in their world market forecast.

Table 2
Commission of the European Communities
Photovoltaic World Market Forecast

Projected Annual Sales	Volume MWp/Year	System Cost $/Wp	Sales Value M.$
in 1982	11	15	165
in 1985	60 - 80	7 - 10	400 - 800
in 1990	120 - 900	3 - 7	700 - 2,200
in 2000	350 - 10,000	1.5	1,400 - 15,000

Substantial PV R&D activities and industries now exist in many countries in Europe. The EEC PV Program as well as individual countries' PV research and development programs, have spurred a rapidly-developing European industry. Companies now have module production and sales in Germany, France, Italy, the Netherlands, Belgium, Great Britain, and Switzerland. Appendix A is a listing of the companies active in PV in each country and their capabilities.

The EEC Photovoltaics R&D Program was initiated in 1975, and focused in the first four years largely on basic and applied research. Beginning in July 1979, the second four year program shifted emphasis to the practical problems of PV module and sytem development with a large percentage of the funding going into technology development, test facilities and prototype systems. As of December 1981, the EEC R&D activity consisted of 56 contracts with industry, Universities, and National laboratories throughout Europe. There are 18 jointly funded prototype systems projects underway totalling 1.3MW with the EEC Program funding $11M of the $33M projected cost. The remainder of the cost comes from individual national and industrial cost-sharing sources. These experimental systems are all relatively large, ranging in size from 30 to 300 kWp per project. Applications include village power, water pumping, desalination, and TV transmitter power systems. All 18 projects are expected to be completed within a year (by June 1983).

Many European nations have their own PV programs administered through a National Energy Department or equivalent. For example, Italy has an extensive national program administered through ENEA, the national energy research and development agency, which is roughly equivalent to the former U.S. ERDA organization. The ENEA renewable energy plan is dominated by the photovoltaics activity, which is 40% of the total expenditures. Italy has a goal of 1% of national electrical energy production by the year 2000 using photovoltaics. The ENEA photovoltaics budget will receive a total of $70M over the 1982-84 period.

ENEA funds PV research in its own laboratories, as well as in industrial laboratories, and, in addition, funds experimental field projects. These activities are in addition to those being funded and managed through the European Economic Community (EEC). The ENEA promotes domestic PV applications and expects several megawatts of rural residential applications for the relatively near future. Other significant power applications are expected to be developed on a number of small Mediterranean islands.

ENEA is now building a laboratory facility in Naples which will be devoted to PV research activities similar to those carried out at JPL/FSA and at SERI. They are working on silicon technology as well as amorphous silicon and thin film GaAs . Concentrator technology is viewed as a long term technology with no immediate application and thus, is not being pursued at this time in the Italian program.

Many European countries are moving toward national incentives. For example, the Italian Government now has a bill in process to be signed into law early in June to provide a major incentive for photovoltaic power application to remote rural housing. Italian law requires that all full-time, lived-in residences in the country eventually be provided with electric service. The pending bill provides for the government to pay 80% of the total cost of installations on remote residences in Italy. This activity alone should create a significant domestic market for the Italian PV module manufacturers.

The Delphos Project, at 1.2MWp, is the largest of the Italian ENEA application experiments. Delphos is expected to be a fixed, flat-plate central power plant experiment with battery storage to provide continuous power to the load either with or without grid interconnection. The plant will be built with 50:50 ENEA, ENEL funding. ENEL is the Italian National electric utility. The site chosen is in S. E. Italy. It is expected that the modules for this facility will be supplied half from Solaris and half from Ansaldo. The procurement and installation are expected to occur over a four year period with the first step being 60kW to be purchased this year. Additional procurements of 240, 300 and 600 kW will then complete the facility.

From the above, it can be seen that the Italian National PV program is significant, rivaling the EEC program in size and scope. Other European countries also have national PV program activities, although not as large generally as that in Italy. When the total government activity in Europe is summed, it is estimated to be at least of the same order as the present U..S. PV Program budget. As in Japan, European PV budgets are tending to increase over the next few years. It is reasonable to assume, then, that the U.S. could shortly lose its preeminent position in World Photovoltaic Technology.

IN SUMMARY:

- Annual funding of PV R&D by the Japanese Sunshine Project along with private participation through labor contribution is now comparable with that of U.S. DOE allocations. Similar statements can be made with respect to the sum of European Program activities being of the same order as the U.S Program.

- 75% of the Sunshine Project funding is for the mass-production technology development of flat-plate crystalline silicon solar cell arrays and for systems experiments . Most of the remaining funds are for the development of a-Si solar cell technology for which Japan is striving to maintain its leading position.

- European PV Programs are strongly-directed toward near-term, remote, stand-alone and export markets with much of the industrial production utilizing "solar grade" silicon and cast ingot technologies.

- The near-term markets for the Japanese PV products are consumer products, domestic dispersed PV systems, and international sales for stand alone applications. Japan is preparing to develop a strong international PV market position when such opportunities emerge.

- Both European and Japanese PV Program long-range objectives are for PV to become a viable grid-connected power option.

- European and Japanese PV Program budgets are expanding in strong support of their PV industry.

- Neither Japanese or European Programs have extensive concentrator activities.

CLOSING REMARKS:

NOTE: FOR EDITOR'S INSERT

LIST OF APPENDICES

A. European Industry and Institutions Active in PV
B. European Experimental Systems
C. Japanese Sunshine Project Funding
D. Japanese Photovoltaic Program Schedules
E. Japanese Research and Development Activities in 1980
F. Japanese Photovoltaic Manufacturers
G. Summary of Recent Japanese Achievements in Amorphous Silicon

APPENDIX A: EUROPEAN INDUSTRY AND INSTITUTIONS ACTIVE IN PV

Country	Company	Technology Activity	Manufacturing Capability	Affiliation
Germany	o Wacker Chemitronics	Polycrystalline Silicon refining	1800 M Ton/Y	No
	o AEG Telefunken	Modules	150 kWp 1980 1000 kWp 1982 (Forecast)	No No
	o Siemens	Modules	2 MWp/Y 1983/ 1984	No
	o NUKEM	Cd-Sulphide thin film cell	-	-
France	o Societe Francaise de Photopiles	Modules	300 kWp/Y 1980 5 MWp/Y by 1985	Photowatt
	o Photon	Cells/Modules	300 kWp/Y 1981 1 MWp/Y by 1985	Solarex
	o Total Oil	Systems		Photon Power
Italy	o Ansaldo (100% Government) owned)	Cells/Modules	400 kWp/Y to date	-
	o ENI (Government owned 75%)			
	a) Solaris	a) Solar Grade Silicon Arc Furnace b) Ingot Casting SEMIX c) Cells/Modules d) Systems	200 kWp/Y-1982 4-6 MWp/Y-1986	Solarex
	b) Pragma	Solar Grade Silicon	500 MT/Y-1984	Solarex
	c) Agip Nucleare	Systems	-	No

APPENDIX A (cont): EUROPEAN INDUSTRY AND INSTITUTIONS ACTIVE IN PV

Country	Company	Technology Activity	Manufacturing Capability	Affiliation
Italy	o ENEA (Government agency)	Research & Experimental Systems	70 M budget for 1982, 1983, & 1984	-
	Adriatica Componerti Elettronici	a) Modules b) Solar Grade Silicon		Siemens
Netherlands	Holec Solar Energy	System		Solarex
Belgium	o Belgosolar (90% Government owned)	Cells/Modules	250 kWp/Y 1982	–
	o E.N.E. Energie Nouvelle et Environnement	Cells/Modules	150 kWp/Y 1981	Solarex
England (UK)	o Lucas - BP Solar System	Modules/Systems	-	-
	o Solapax	Systems (Import modules from US)		Solarex
Switzerland	o ?	Fully - Integrated PV production plant	-	ENI (Italy) Standard Oil (Solarex
	o Photonetics	Modules	1MW$_p$/Year	Societe Romande d' Electricte Parsan, Inc

APPENDIX R: EUROPEAN EXPERIMENTAL SYSTEMS

COUNTRY	PROJECT	SYSTEM DETAILS	FINANCED BY
ITALY - DELPHOS PROJECT		1.2 MWP FLAT PLATE WITH BATTERY STORAGE, OPERATED WITH OR WITHOUT GRID CONNECTION. FOUR YEARS PROCUREMENT, 60 KW, 240, 300, 600 KW, (12) 100 KW SUB-FIELDS WITH SWITCHING MATRIX (12) 100 KW SELF COMMUTATED INVERTERS	50% ENEA 50% ENEL
	ALICUDI ISLAND	80 KWP STAND ALONE VILLAGE POWER	EEC
	TREMIDI ISLAND	65 KWP OSMOSIS DESALINATION PLANT (BATTERY STORAGE)	
	GIGLIO ISLAND	45 KWP DRINKING WATER DISINFECTION, AND FISH (ICE MAKING) PRESERVATION	
FRANCE	° REUNION ISLAND	55 KWP REMOTE VILLAGE POWER	
	° MONT BOUQNET	50 KWP TV TRANSMITTER GRID BACK-UP	
	° NICE AIRPORT	50 KWP AIRCRAFT NAVIGATION SYSTEM	
	° CORSICA RONDOLINU ISLAND	44 KWP STAND ALONE (MAY BE GRID CONNECTED)	
ENGLAND	SOUTHAMPTON	80 KWP STAND ALONE (MAY BE GRID CONNECTED)	
DENMARK	VESTER ROJEBJERG	100 KWP VILLAGE POWER WITH BATTERY STORAGE AND GRID CONNECTION FOR EMERGENCY BACK-UP	
GREECE	KYTHNOS ISLAND	100 KWP VILLAGE POWER IN PARALLEL WITH DIESEL GENERATOR AND 60 KW WIND GENERATOR	
	CRETE ISLAND	50 KWP VILLAGE POWER, BATTERY STORAGE AND DIESEL GENERATOR BACK-UP	
	AGHIA ROUMELI	50 KW VILLAGE POWER STAND ALONE	

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APPENDIX B (cont): EUROPEAN EXPERIMENTAL SYSTEMS

COUNTRY/PROJECT		SYSTEM DETAILS	FINANCED BY
Germany	Pellworm Island	300 kW General utilization power in parallel with wind power	EEC
Belgium	Chevetojne	63 kW Connected to utility grid	
Ireland	Foter Island	50 kW Village power stand alone	
Holland	Hoboken	30 kW Naval training school	
Italy	Southern Area	600 kW to power 600 houses, 1 kW each, in remote villages in southern Italy	ENEL

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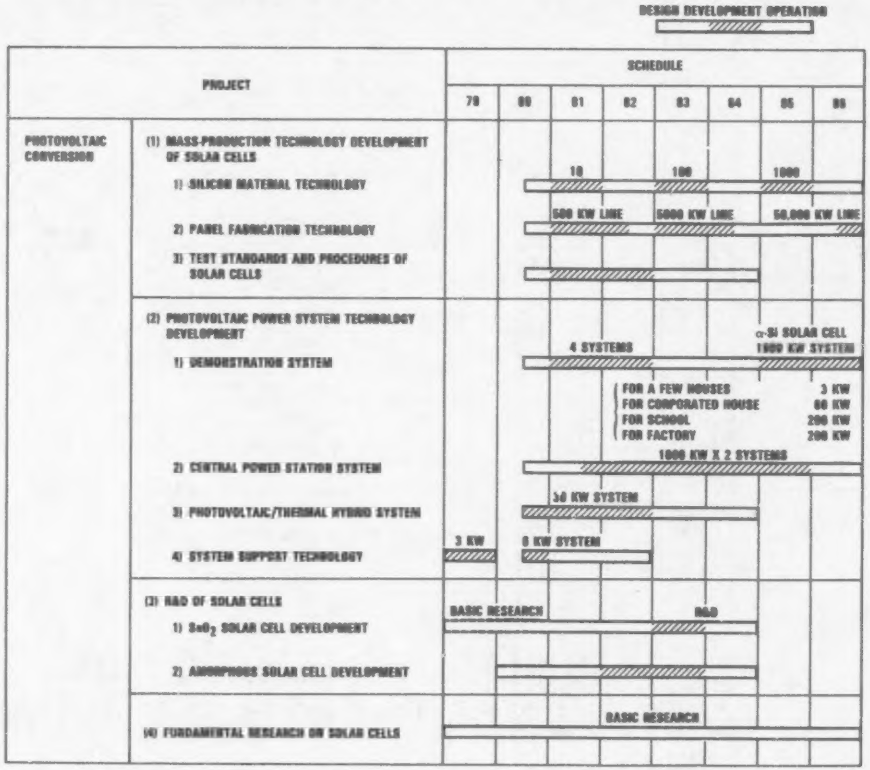
APPENDIX C

JAPANESE SUNSHINE PROJECT FUNDING

	FY, $M		
	1980	1981*	1974-1981
Solar Energy	41.5	34.7	122.8
Geothermal Energy	37.4	42.7	134.4
Coal Conversion	37.4	58.9	129.1
Hydrogen Energy	4.1	4.1	21.5
Other	4.1	5.9	26.2
Total	124.5	146.3	434.1

*April 1, 1981 – March 31, 1982

JAPANESE PHOTOVOLTAIC R&D SCHEDULE



APPENDIX E

JPL → JAPANESE RESEARCH ACTIVITIES IN 1980 FROM CONFERENCE REPORTS

CLASSIFICATION	TITLE OR ABSTRACT	COMMENTS	COMPANY OR INSTITUTION	CONFERENCE
LOW-COST TECHNOLOGY	FLUIDIZED BED REACTOR GRANULAR SOG Si	3 INCH ϕ, CZ, $\eta = 8\%$ (MEAN).	HITACHI AND SHIN ETSU CHEMICAL	PVSEC-2
	FLUIDIZED BED REACTOR GRANULAR SOG Si	2 INCH ϕ, CZ, $\eta = 11\%$ (MAX.) FROM $SiCl_4$, $\eta = 13\%$ FROM $SiHCl_3$.	HITACHI AND SHIN ETSU CHEMICAL	CSSD-12
	HIGH CURRENT IMPLANTOR FOR SOLAR CELL	70 mm ϕ WITH MORE THAN 10 mA BEAM $\eta = 9.7\%$, WRONG EFFECT BY H^+, BH^+.	HITACHI	PVSEC-2
	LASER ANNEALED SOLAR CELL	CHARACTERIZATION OF LA CELLS.	NAGOYA INSTITUTE OF TECHNOLOGY	PVSEC-2
	SnO_2/n^+ p poly Si SOLAR CELL	PHOSPHOROUS ACID DIP AND DIFFUSION, $\eta = 6.5\%$ (MEAN) BY SILSO FROM WACKER.	OSAKA U.	PVSEC-2
HIGH EFFICIENCY APPROACH	SQUARE SHAPED Si CELL	$\eta = 13.8\%$ (41 cm^2), 20% IMPROVEMENT IN MODULE EFFICIENCY OVER CIRCULAR CELLS	HITACHI	PVSEC-2
	Al GaAs/GaAs CELL FOR CONCENTRATION USE	$\eta = 22\%$ (100 SUNS), 1 kWp ARRAY, PASSIVATION SOLVED.	MITSUBISHI	PVSEC-2
	MULTI-CELL WITH GaAs, Si, Ge	FEASIBILITY STUDY ($\eta = 64.8\%$) AND OVERALL EFFICIENCY FORECAST ($\eta = 23\%$) BASED ON ACTUAL CELL CHARACTERISTICS	TOKYO U. AND MITSUBISHI	PVSEC-2
MIS	InP CELL	Al-200°C OXIDE-p-InP WITH Sb_2O_3 ANTI-REFLECTION COATING, $\eta = 14\%$, BUT DEGRADATION OBSERVED.	TOKYO INSTITUTE OF POLYTECHNICS AND AOYAMA GAKUIN U.	PVSEC-2
	GaAs CELL	HIGH EFFICIENCY BY ANODIZATION, INTERFACIAL STATE CONSIDERATIONS.	HOKKAIDO U.	PVSEC-2
	Be-I-$_p$Si CELL	450-500°C THERMAL OXIDE, $\eta = 8.5\%$ (1.1 cm^2) Be EVAPORATION WITH θ = 70°-80° FROM NORMAL	HOXAN RES. LAB.	PVSEC-2
	Mg-I-$_p$Si CELL	400°C THERMAL OXIDE, $\eta = 2\%$, NEEDS REFLECTANCE IMPROVEMENT.	KYOTO U.	PVSEC-2
OTHER MATERIALS	InP	n-CdS/n-InP/p-InP STRUCTURE IMPROVES BOTH SPECTRAL RESPONSE AND VI CHARACTERISTICS.	CHIBA U.	PVSEC-2
	ORGANIC SEMICONDUCTOR CELL	Al/ZnO/MEROCYANINE-DYE/Ag CELL: I_{sc} = 0.7 mA/cm^2, Voc = 0.4 V, FF = 0.4 (78 mW/cm^2 XENON LAMP).	TOKYO INSTITUTE OF TECHNOLOGY, JIKEI U. & ELECTROTECH. LAB.	PVSEC-2

PVSEC-2: THE 2nd PHOTOVOLTAIC SCIENCE AND ENGINEERING CONFERENCE IN JAPAN, DEC. 2-4, 1980, Science Council of Japan, Roppongi, Tokyo.

CSSD-12: THE 12th CONFERENCE ON SOLID STATE DEVICES, AUG. 26-27, 1980, Tokyo.

(OTHER THAN THE TOPICS LISTED ABOVE, THERE WERE MANY MORE BASIC PAPERS PRESENTED THIS YEAR AT MANY CONFERENCES.)

BEST COPY AVAILABLE

JAPANESE PV MANUFACTURERS

COMPANY	ESTIMATED 81 PRODUCTION, kW	USE
JSEC (EFG Ribbon)	300	Stand Alone and Export
Sharp	300	Stand Alone and Export
NEC	100	Company Built Microwave Products
Sanyo (aSi)	100	Consumer Products
Teijin Komatsu Fuji (aSi) Matshushita (Panasonic) Toshiba	~200	Most Sales to Government

APPENDIX G

SUMMARY OF RECENT JAPANESE ACHIEVEMENTS IN AMORPHOUS Si SOLAR CELL PERFORMANCE

MATERIAL	JUNCTION STRUCTURE	EFF (%)	VOC (mV)	JSC (mA/cm²)	F.F (%)	PIN (mW/cm²)	AREA (cm²)	INSTITUTE PRESENTED	DATE & REFERENCE
a-Si:H (SMALL AREA)	ITO/pa-SiC:H/ina-Si:H/Al	8.04 7.90	880 843	15.21 13.5	60.09 69.4	100 100	0.033 0.04	OSAKA UNIV. SANYO	ANNUAL MEETING OF J.A.A.P. (OCT. 8, 1981)
	SnO_2/pa-SiC:H/ina-Si:H/Al	7.82 7.62	903 900	13.76 14.6	62.93 58.0	100 100	0.033 0.009	OSAKA UNIV. SUMITOMO ELECTRIC	
	SnO_2/pin a-Si:H/Al	7.19 6.26 5.81	820 910 700	11.1 11.43 11.8	63.1 59.7 57.0	80 100 100	0.046 0.031 0.09	TAIYO YŪDEN KOMATSU ELECTRONIC SUMITOMO ELECTRIC	
	ITO/pin a-Si:H/Al	6.3	850	11.9	62.5	100	0.16	TOKYO INST. TECH.	
	SnO_2/Cr/pin a-Si:H/Cr	4.04	715	7.55	51.1	68.3	0.002	ETL	
	ITO/nip a-Si:H/S.STEEL	6.91 6.88 6.55	875 880 837	13.0 12.3 12.1	62.0 63.6 59.83	100 100 92.5	0.04 0.09 0.09	SANYO MITSUBISHI ELECT. TEIJIN	(OCT. 8, 1981) PRIVATE COMM.
	ITO/SnO_2/pin a-Si:H/Al	6.50	810	12.0	67.0	100	0.09	MATSUSHITA ELECT.	PRIVATE COMM.
a-Si:H (LARGE AREA)	ITO/SnO_2/pa-SiC/ina-Si:H	7.72	880	14.06	62.38	100	1.00	OSAKA UNIV.	ANNUAL MEETING OF J.A.A.P. (OCT. 8, 1981)
	ITO/pa-SiC/ina-Si:H/Al	5.8	6700	11.9	63.0	100	100.0	SANYO (9 SERIES(L))	
	ITO/n μc-Si/pa-Si:H/S.S.	7.8	860	13.9	65.5	100	1.2	FUJI ELECTRIC	
	ITO/nip a-Si:H/S.STEEL	5.03 4.7	800 890	10.82 10.6	54.6 50.0	92.3 100	100.0 100.0	MITSUBISHI ELECT. FUJI ELECTRIC	
a-Si:H:F	ITO/nμc-Si:H:F/pa-Si:H ITO/nip a-Si:H:F/S.STEEL ITO/na-Si:H:F/pa-Si:H/S.STEEL	5.1 4.5 4.2	840 610 815	9.78 13.2 8.35	62.1 55.9 61.7	100 100 100	0.04 0.25 0.04	SANYO FUJI ELECTRIC SANYO	
a-SiGe:H (STACKED CELL)	ITO/nipn a-Si:H/ i a-SiGe:H/p a-Si:H/S.S.	7.73	1410	9.62	57.0	100	0.25	MITSUBISHI ELECT. (2 CELL STACKED)	(OCT. 8, 1981)

SURVEYED BY HAMAKAWA LAB.
(COURTEST OF PROF. HAMAKAWA)

KS - 11/13/81

Mr. GORE. Thank you very much. That sure does provoke a lot of questions, but we will hold them until our last witness has presented his testimony.

Mr. Bartlem, welcome to you. Please proceed.

Mr. BARTLEM. Thank you very much, Mr. Chairman.

Since I am the last I will try to keep my remarks brief.

I am Todd Bartlem, and I work with the International Institute for Environment and Development based here in Washington. We are an international organization and we have a board of directors and staff that are drawn from both the developing and developed worlds. We have offices in Washington, London, India, and Argentina, and affiliated institutions in Sudan, West Germany, and Nigeria.

For the past 2 years I have been involved in a study of the potentials for the transfer of renewable energy technologies from the North to the South. Our work was financed by a number of different governments, including the Dutch, the West German, French and American Governments as well as a United Nations agency.

Our report has just been produced. I believe parts of that were given to the members today in preparation for these hearings, and our final report will be issued around July 1.

The study itself is wide in scope and includes analyses of various high technologies that were being developed, who the suppliers of the technologies might be—the Japanese, Europeans, or Americans—and most importantly what infrastructure was in place in the developing countries to receive those technologies.

I might also mention that I worked on this project with two coauthors, one Thomas Hoffmann, who is in our Washington office, and the other one, Anil Agarwal from New Delhi, India.

My perspective is a bit different from the other people who have spoken before the committee today. My real concern is based less on whether or not the United States is winning a technology race with others and more on how these new technologies are being transferred to developing countries.

From what I can tell, until last year there was no doubt that the United States was in the lead in most areas of renewable technology development, especially in the areas of photovoltaics and wind. In fact, many of the European and Japanese competitors relied heavily on U.S. research and patents to get themselves started. This early technical lead, however, was never matched by a business and scientific push to facilitate the transfers of U.S. solar goods, services, and know-how to the developing world.

Through the USAID and Department of Energy, several large demonstration programs were established in other countries, some at great expense. Yet few of them were of long lasting nature or replicable in the countries chosen.

One fact has emerged from these tests conducted by the Americans the Europeans, and the Japanese. That fact is that photovoltaic cells, solar thermal systems, wind generators, and a number of other technologies will be able to provide developing countries with reliable sources of decentralized power at some time in the future. Yet the primary blockage remaining is the most of these technologies are very capital intensive on the front end. In our work we found that some of these new technologies cost two or three times as much as nuclear energy in terms of capital cost per kilowatt of generation capacity. These costs are decreasing through technical improvements and increased economies of scale and production. However, developing country energy shortages are usually accompanied by shortages of hard currency—foreign exchange—to purchase any energy replacement from foreign sources, even if over the long term renewable energy might be more economical.

There are many instances of this. But it is just easier with little cash in pocket to continue paying the fuel bills as they come in. Other countries that are looking to developing countries as an export market have had to deal with this. The French, the Germans, and the Japanese have all relied on government incentives tightly tied to foreign aid and export promotion programs to get their technology, both their goods and services transferred into developing countries.

For example, the French have the responsibilities for their R&D national renewables policymaking and international R&D and AID cooperation for renewables in the same agency, the Commissariat L'Energie Solaire. COMES has an important relationship with most of the semipublic and private firms developing new energy products. In May 1982, COMES was subsumed under a new agency the Agence Française Pour La Maîtrise de L'Energre.

It cannot be said that the French have not had their share or problems with technologies. They have had tremendous problems and they have yet to see any break-throughs as far as self-sustaining markets are concerned. Yet they do have an inordinate amount of field experience, primarily in developing countries. And the links among their government R&D groups, their universities, their aid programs and their commercial firms are very tight, and constitute a formidible barrier to anybody trying to enter into competition with them, especially in Francophone country markets.

The Germans had not quite as large a program as the French, but they have what is perhaps one of the most innovative programs of industrial cooperation. Like the French, the Germans have kept their industries allied with international R&D programs. Yet rather than continuing to push for the development of entire systems produced for export as the French have done, Germany has linked its firms to industrial R&D relationships with other countries.

For example, Dornier Systems Gmb H, a big German aerospace manufacturer has been working on the small solar pumping station in cooperation with an Indian firm called Bharat Heavy Electricals. From this experience they hope to license their technology and sell special high technology components to the Indians further down the road. Other such ventures are underway in Egypt and Mexico and Jordan.

The Japanese have not really geared up to produce and to export renewables products on a large scale, but they are very strong finishers. The Ministry for International Trade and Investment works closely with the New Energy Development Organization to channel research toward potential export markets.

The solar industry managers also utilize private and public marketing ventures, like the Engineering Consulting Firms Association. ECFA is a trade association of major energy firms which sends out teams to do market appreciation studies abroad gaging what opportunities might be open for Japanese technical capabilities. ECFA has sent several renewables missions into Southeast Asia, not to identify immediate market opportunities, but rather with the aim of identifying partners for long-term collaboration.

I might mention here that when we started this study we concentrated on Japan, France, and Germany, because those seemed to be the real comers. Since then things have changed markedly. The Italians, Canadians, Australians, and Dutch have all become increasingly active in promoting their renewable technologies. The Canadians announced last August a 5 million [Canadian $] fund to promote joint ventures between Canadian renewables campanies and Third World partners.

What does this type of technical and commercial competition in the Third World, mean to the United States and, more importantly, what can the United States do to meet that challenge?

In my opinion renewable energy in the industrialized world has now made a transition from the sort of mythical stage of its existence to a more utilitarian stage of development. Early tests have shown that renewable energy can be just as capital intensive centralized, and commercialized as any other energy source.

The goal of the U.S. research and business community must be to link the technical gains of the past 10 years to a least cost strategy for energy provision over the long term. Government has a role to play there. Even though America's solar enthusiasm has been dampened, there still remains a very positive record of accomplishment and public acceptance of renewables and conservation technologies.

The developing world is a step behind that. They are only now reexamining the solar energy myth. For the most part the major proponents of solar energy in the countries we visited are still colar research scientists and solar activists.

To a certain extent one finds a renewables backlash from Third World policymakers and businessmen in many countries. They see the solar option as just another scheme cooked up by the industrialized world to keep the oil for themselves or as just another product of the United States, European, and Japanese industrial machine for Third World consumers to buy.

Yet, from what we can tell, there are indications that many developing countries, especially the larger ones, have begun to follow the North's lead and are going to look at renewables in a very utilitarian fashion.

Consider that India, Brazil, and South Korea have all launched large R&D programs in solar energy and are beginning to provide fiscal and legal incentives for their consumers.

If the Third World market does exist and the United States has the technologies to sell, what can the U.S. Government do to promote this exchange? Most of these countries do not have the disposable cash to purchase these technologies. The larger countries will probably not be content to be the customers of the United States or of any other country. More and more developing countries see solar energy strategically and they want to insure an energy supply that is under their national control. It makes no difference whether it's oil, coal, or solar. Thus, the tendency in most countries, again the

Indias, South Koreas, Kuwaits, and Brazils, is to get a piece of the action, either through funding their own R&D capabilities for renewable energy or by encouraging the establishment of local businesses which sell or distribute renewables on a joint venture, license or distributorship basis with Western companies.

Many times those ventures are undertaken not just for domestic markets but with an eye for eventual exports back to the United States and Europe. This has already happened in South Korea. Here, in fact, technology transfer might imply creating your own competitors in the long term. Yet, we are of the opinion that the fledgling U.S. solar industry could probably benefit from sales of components and other services to developing countries in order to give themselves breathing room until their own products become competitive in the U.S. market.

I have three specific recommendations for U.S. Government action stemming from the work we have been doing. These are all derived from the belief that encouraging solar energy technology transfers to the Third World must balance both short-term commercial priorities of U.S. industry and the long-term development of a science infrastructure in developing countries. One will need the other if they both are to flourish.

First, I would strongly recommend the reinstatement of cooperative R&D programs between the Solar Energy Research Institute in Colorado and foreign research centers. I believe that SERI's international presence was unwisely eliminated. By providing technical leadership and access to the world's most complete renewables library and computerized information system, SERI had no other rivals in the world. In addition, other cooperative research exchanges with U.S. laboratories and universities must be strengthened.

Second, hand in hand with this technical assistance, the U.S. Government can boost the transfer of its technology abroad by supporting bilateral and multilateral development assistance programs, which seek to address the biggest challenge facing most developing country scientists, how to get their ideas and products out of the laboratory and into the marketplace.

This will require a reorientation of national policies for encouraging the use of locally generated know-how, and for the proper internal pricing of energy sources. These types of programs have been proposed by USAID, the World Bank, the United Nations Development Programme, and others. They should be encouraged.

Finally, in the shorter term, the U.S. Government may wish to foster links between U.S. firms with expertise and experience with renewable energy, and developing country entrepreneurs who might be interested in utilizing U.S. technology to substitute for imported oil. As I mentioned above, governmentally sponsored programs to encourage these kinds of exchanges already exist in France, West Germany, and Canada.

I might mention one initiative that my institute is organizing along these lines. In cooperation with USAID, Appropriate Technology International, the World Bank, the U.N. Development Programme, and the U.N. Secretary-General, we will be holding a series of three or four meetings to bring together private solar energy businesses, government officials and potential investors form both developed and developing countries to reexamine the potential for increased cooperation and new opportunities for trade. Firms with special products and services of greatest interest to developing countries will be invited to participate. The first of these workshops is scheduled to be held in New York in late September, followed by workshops in two or three developing countries, perhaps Jamaica, Kenya, and the Philippines, in late 1982 and early 1983.

[The prepared statement of Mr. Bartlem follows:]

STATEMENT OF TODD BARTLEM

I am Todd Bartlem, a Research Associate with the Washington office of the International Institute for Environment and Development. The IIED is a policy research organization which is genuinely international in its approach to development issues. Our Board of Directors and staff are drawn both from the developed and developing world; we have an office in London and formal cooperative affiliations with institutes in India, Argentina, Nigeria, the Sudan, and West Germany.

For the past two years, IIED has carried out a comparative study of the potentials for the transfer of renewable energy technologies from North to South. This study was financed by the Dutch, West German, French, and American governments, and the United Nations. Our draft report is presently out for comments, and will be published in its final form around July 1. The scope of the study was fairly wide, as it included analyses of _what_ technologies might be transferred, _who_ the suppliers of such technology might be (Northern industry), and _what_ infrastructure was in place to receive, absorb and utilize these technologies in developing countries. In the final tally, our team (which included Thomas Hoffmann from IIED Washington and Anil Agarwal from our affiliated institution in New Delhi) talked with individuals and groups in fourteen countries. My own concern is based less on whether or not we are winning the technical race with others, and more on how new technologies are being transferred to developing countries. Hopefully I can add a different perspective to the topic under discussion today.

Until last year, there was no doubt that the US was in the lead in many areas of renewables technology development, especially photovoltaics and wind. In fact, many of our European and Japanese competitors relied heavily on U.S. research and patents to get them started. This early technical lead, however, was never matched by a business and scientific push to facilitate transfers of U.S. solar goods, services and know-how to the developing world. Through USAID and the Department of Energy, several large demonstration programs were assembled in other countries, some at great expense. Yet few were of a long-lasting character or were replicable within the countries chosen for the tests.

One fact has emerged from these tests. It is now known that photovoltaics cells, solar thermal systems, and wind generators, just to mention a few, can provide developing countries with reliable (though in some cases intermittant) sources of decentralized power, yet they have the disadvantage of being very capital-intensive on the front end. In our work we found that some renewables technologies cost two or three times as much as nuclear energy in terms of capital cost per kilowatt of generation capacity. These costs are decreasing through technical improvements and increased economies of scale of production. However, the developing country energy shortage is most usually accompanied by a shortage of hard currency to purchase an energy replacement from foreign sources, even if over the long-term renewable energy saves them money. It is just much easier to continue paying the fuel bills as they come along.

How have other countries dealt with this situation? The French, Germans, and Japanese have all relied on government incentives tightly tied to foreign aid and export promotion programs to get their technology transferred to developing countries. For example, the French have centered the responsibility for their R&D programs, national renewables policymaking, and international R&D and aid cooperation for renewables in the Commissariat a L'Energie Solaire (COMES), under the Ministry for Industry. COMES has an important, unique relationship with most of the semi-public and private firms developing new energy products. I spent three weeks in Senegal visiting and talking to salesmen, government bureaucrats and villagers about solar photovoltaic pumps, solar thermal electric generators, and aerogenerators installed by French firms such as Leroy Sommer, Pompes Guinard, Sofretes and Aerowatt with French aid and European Development Fund money. I must say that the French have had more than their share of problems with technologies, and they have yet to see breakthroughs as far as self-sustaining markets are concerned. Yet they do have an inordinate amount of field experience primarily in developing countries -- and the links among their government R&D groups, universities, aid programs, and commercial firms are very tight and constitute a formidable barrier to entry of other solar salespeople into Francophone country markets.

Germany lags behind the U.S. and France in funds spent, but it has had what I consider to be the most innovative programs of industrial cooperation. Like the French, the Germans have kept their industries allied with their international R&D programs. But rather than continue to push for the development of entire systems produced for export, as the French have done, Germany has linked its firms to industrial R&D relationships with other countries. For example, Dornier systems of Friedrichshaften has been working on small solar pumping stations with an Indian firm (Bharat Heavy Electricals) for several years, and from this experience hopes to license its technologies, and sell high technology components to the Indians later. Other such ventures are underway in Egypt, Mexico and Jordan. The German firms (which include M.A.N., M.B.B., and AEG Telefunken) have their expenses paid 100% by the National Ministry for Research and Technology. In addition, the German aid programs provide technical aid in new energy sources abroad, and have increasingly attempted to link national firms with potential customers.

The Japanese are not yet geared up to promote renewables product sales on a large scale. But as General Motors, Ford and Chrysler have painfully learned, the Japanese are strong finishers. The Ministry for International Trade and Investment works closely with the New Energy Development Organization to channel research towards potential export markets. Solar industry managers also utilize public/private marketing ventures like the Engineering Consulting Firms Association (ECFA) which has no exact counterpart in Europe or America. ECFA is a trade association of major energy firms which periodically sends out teams to conduct market appreciation studies abroad, gauging what opportunities might be open for Japanese technical capabilities. ECFA has sent several renewables missions into Southeast Asia, not to identify immediate market opportunities, but rather with the aim of identifying partners for "long-term collaboration."

Other governments, notably Italy, Canada, Australia and the Netherlands, have become increasingly active in promoting solar technologies produced in their industrial and research centers, and have targeted Latin America and Southeast Asia as important potential markets. The Canadians, in fact, have set up a CN $5 million fund to promote joint ventures between Canadian renewables companies and Third World partners. Details of these programs are contained in our report, a copy of which will be made available to the Committee upon publication in early July.

What does this type of technical and commercial competition in the Third World mean to the United States and, more importantly, what can it do to meet this challenge?

In my view, renewable energy in the industrialized world has now made a transition from the "mythical" stage to the "utilitarian" stage of development. Early tests have shown that renewable energy can be just as capital-intensive, centralized, and commercialized as any other energy source. The goal of the U.S. research and business community must be to link the technical gains of the past ten years into a least-cost strategy for energy provision over the long-term. Even though America's solar enthusiasm has dampened, there still remains a very positive record of accomplishment and public acceptance of renewables.

The developing world is only now re-examining the solar energy myth. For the most part, solar's major proponents in these countries still are "solar activists" and research scientists. To a certain extent, one finds a "renewables backlash" from Third World policymakers and businessmen in many countries, who see the "solar option" as just another crazy scheme cooked up by the industrialized world to keep the oil for themselves, or as another product for Third World consumers to buy.

Yet indications are that many developing countries will follow the North's lead, and begin to look at renewables in a "utilitarian" fashion. Consider that India, Brazil, and South Korea have all launched large R&D programs in solar energy, and are beginning to provide fiscal and legal incentives for consumers. Certain renewables products offer reliable services such as fresh water, electric lighting, and vaccine refrigeration in remote areas where electric transmission lines do not reach and where diesel generation is expensive and unreliable. Although this kind of market is nearly impossible to quantify due to the cash-poor nature of Third World rural areas, it does exist. The more immediate sales opportunities, such as solar hot water for hotels and remote telecommunications linkages powered by photovoltaic cells, are already being pursued in most of the countries we visited.

If the Third World market does exist, and the U.S. has the technologies to sell, what can the U.S. Government do to promote this exchange? Most of the Third World countries having the disposable cash to purchase these technologies will probably not be content to be customers of the U.S. or of any other country. More and more developing countries see solar energy "strategically," and want to ensure an energy supply that is under their national control. Thus the tendency in countries like India, South Korea, Kuwait, and Brazil is to "get a piece of the action," either through funding their own R&D capabilities in renewable energy, or by encouraging the establishment of local businesses which sell or distribute renewables on a joint venture, license or distributorship basis with Western companies. Many times these ventures are undertaken not just for domestic markets, but with an eye for eventual exports back into the U.S. and Europe. Here, in fact, technology transfer might imply creating our own competitors in the long-term. Yet who can say that the fledging U.S. solar industry would not benefit from continued sales of components and other services to developing countries, in essence giving the industry breathing room until its products become competitive in home markets?

I have three specific recommendations for U.S. Government action. These all derive from the belief that encouraging solar energy technology transfers to the Third World must balance both the short-term commercial priorities of U.S. industry and the long-term development of a science infrastructure in developing countries. One will need the other if they both are to flourish.

First, I would strongly recommend the reinstatement of cooperative R&D programs between the Solar Energy Research Institute and foreign research centers. I believe that SERI's international presence was grossly underestimated, and unwisely eliminated. By providing technical leadership and access to the world's most complete renewables library and computerized information system, SERI had no rivals in the world. In addition, other cooperative research exchanges with U.S. laboratories and universities must be strengthened.

Second, hand-in-hand with this technical assistance, the U.S. Government can boost the transfer of its technology abroad by supporting bilateral and multilateral development assistance programs which seek to address the biggest challenge facing most developing country scientists -- how to get their ideas and products out of the laboratory and into the marketplace. This will require a re-orientation of national policies for encouraging the use of locally-generated know-how, and for the proper internal pricing of energy sources. These types of programs have been proposed by USAID, the World Bank, the UN Development Programme, and others. They should be encouraged.

Finally, in the shorter-term, the U.S. Government may wish to foster links between US firms with expertise and experience with renewable energy, and developing country entrepreneurs, who might be interested in utilizing U.S. technology to substitute for imported oil. As I mentioned above, governmentally sponsored programs to encourage these kind of exchanges already exist in France, West Germany, and Canada.

I might mention one initiative that my Institute is organizing along these lines. In cooperation with USAID, Appropriate Technology International, the World Bank, the UN Development Programme, and the U.N. Secretary-General, we will be holding a series of three or four meetings to bring together private solar energy businesses, government officials and potential investors from both developed and developing countries to re-examine the potential for increased cooperation and new opportunities for trade. Firms with special products and services of greatest interest to developing countries will be invited to participate. The first of the workshops is scheduled to be held in New York in late September, followed by workshops in two or three developing countries (perhaps Jamaica, Kenya and the Philippines) in late 1982 and early 1983.

Mr. GORE. Thank you very much.

Mr. Shamansky.

Mr. SHAMANSKY. Thank you, Mr. Chairman.

Mr. Bartlem, and also Dr. Ferber, remembering my visits to the State of Israel where I saw a lot of solar panels used for the heating of water. I don't remember much of the testimony today referring to what the Israelis are doing. Are they leaders in this field?

Mr. FERBER In the photovoltaic area, I don't think that Israel has pursued a very extensive program. In the area of solar water heating, it is my belief that they are one of the world leaders, but I am not really an expert in that area.

Mr. SHAMANSKY. You are more of an expert on photovoltaics?

Mr. FERBER. Yes; perhaps Mr. Bartlem can address that question more completely?

Mr. BARTLEM. Yes, sir, there are two leaders in the solar hot water heating game, especially in the small 200-liter units. One of them is Israel. They produce a portable unit that you can basically pick out of a box, set it down wherever you want, on top of your house et cetera, and heat water with it. The prices of them are unbelievably low. The Japanese developed the same sort of device. If memory serves me, these units are priced in the range of $200 to $400.

Mr. SHAMANSKY. Would that be enough for a family to use?

Mr. BARTLEM. Yes, sir, 200 liters. It is not as large as some U.S. systems, but it will supply the basic domestic needs of a family. People can't take 20-minute showers, but it will give them enough warm water to take care of basic needs.

Mr. SHAMANSKY. And the whole unit would cost between——

Mr. BARTLEM. I have seen estimates in the range of $200 to $400. They have exported them. A similar U.S. unit would cost around $1,000 to $1,200.

Mr. SHAMANSKY. A comparable unit?

Mr. FERBER. Yes, sir, but the U.S. units are not stand alone unit, rather they are usually solar collectors that are put on top of the house. By the time you hook up all of the pipes the price goes very high. The secret and the beauty of the Israeli and the Japanese units is that they are self-contained.

We have been looking at the applications of a lot of these technologies to providing basic energy services for developing countries. Our study did not give much attention to the difficulties of providing energy supply options for large American houses. Using photovoltaic cells to run your gigantic refrigerator is not an economical option right now. To run a small vaccine refrigerator in a village it is a very good option. The World Health Organization [WHO] estimates that 75 percent of the vaccine that it buys to ship out to the field arrives in a spoiled state because it has not been refrigerated. If you took that 75-percent savings in vaccine and applied it to a reliable source of refrigeration, you have a very economical proposition.

Mr. SHAMANSKY. Thank you very much, Mr. Chairman.

Mr. GORE. Let me ask both of you to correct the impression that I have of the U.S. program and the opportunities that I believe we are about to miss. Listen to what I have to say and then tell me where I am going wrong.

It is my impression that there is a very large market for photovoltaic arrays in the third world as soon as we cross a cost threshold that is probably 8 to 10 years away from us and that the size of that market is perfectly enormous.

Further, it is my impression that the U.S. program, which started a few years ago, has been imitated and improved upon by many of our international competitors, and that just as we are dismantling our program they are increasing theirs. As a result, it is now likely that at the time this enormous world market opens up, we will probably lose that market to other countries that have exercised more foresight than we have.

Now, correct my impression if you can. Dr. Ferber.

Mr. **Ferber**. Yes, sir, Mr. Gore. I did allude, in my presentation, to some of the concerns that you have.

Mr. **Gore**. The impression I had did not spring full blown from my head. It was based on your testimony in part.

Mr. **Ferber**. Yes, sir, and trying to be brief course I was not able to touch on those points extensively, but I do address them to some extent in my written testimony what I am about to say is my personal opinion.

I believe you are very correct about the fact that foreign programs have mimicked and improved on the U.S. program and I, like you, am very concerned that at a time when the U.S. program is phasing downward, foreign programs, in general, are going upward at a rather significant rate every year. Furthermore, I am very, very concerned about the relative emphasis between the United States and foreign programs. The U.S. program, under the current administration guidelines, is aiming toward a long-range, high risk, R&D industry support, whereas the foreign programs are very much aimed at technology automation and support for the near-term manufacturing needs of industry. They, both in Europe and in Japan, are taking the attitude in general that what they have to do is to build an industry capable of capturing this threshold market that you are referring to and to build that industry before anyone else. They are doing that by heavily supporting automation technology and near term technology development with their industries at a time when we are phasing these activities down. This gives me great cause for concern. I think we are making a big mistake with our U.S. program and with our U.S. industry in moving in this direction.

With respect to the threshold costs and the times of achievement, I believe that for this very large world market to open up, threshold costs of the order of $3 to $5 a watt will be needed. This is, perhaps, a factor of two to three below today's costs.

Mr. **Gore**. Are you talking about cells or complete systems?

Mr. **Ferber**. I am talking about system costs. Some fairly large international remote stand alone applications are very viable at today's costs of systems in the $15 to $20 a watt range. I think we will see the market expanding very rapidly when we get down to $10 a watt system cost on the average and certainly as we get down into the $3 to $6 a watt range in 1980 dollars for systems, that market will indeed be enormous.

I think that there is a good chance that the Japanese, if they continue to take the aggressive stance they are by mimicking our original program plans, building on them and improving on them, could be there in 4 years. I think unless we are able to support our industry in the same way we will lose that market in large extent to the foreign competition and that would be a disaster.

We just don't need another steel industry or automobile industry loss of market to foreign competition, in the United States right now. We have the lead and we can maintain that lead if we are able to work with our industry properly.

Mr. **Gore**. Not under this administration, I am afraid.

Mr. **Ferber**. I have heard that.

Mr. **Gore**. Well, it is subject to change if they will come around on this, but I share your concern.

Mr. Bartlem.

Mr. **Bartlem**. Your impressions, I think, are very correct. I would only make a couple of additions to that. The enormous market that exists in Third World countries is a very particular one with photovoltaic cells and systems one must pay for everything up front. That requires cash. It is paramount to buying a house and paying the gas bill the day you move in.

For cash poor customers in the Third World, and real market that will be developed will depend on how much money small consumers, electric utilities, and various groups in developing countries can scrape together to buy these goods.

There are several services of finance for the purchase of renewable enjoy goods. Many times, capital expenditures usually come about through the assistance of international aid agencies and international banks. Aid agencies are now under attack and commercial banks are becoming very wary of further exposure. So, if the potential for a large market exists for U.S. goods I am not sure how much of it will be translated into actual money in hand for purchase. That is my first comment.

At the same time, I think that the market, when it develops, is not going to be like many others. I think for the high technology components of solar systems silicon production, photovoltaic cell productioner, you will have the United States, the Europeans, the Japanese as the primary producers. The balances of system can possibly be produced by developing contries. If everything goes according to estimates it is the balance of system—the loads—will be the most expensive part of photovotaic systems for example. This includes control systems and appliances. And those sorts of systems developments, I think, are probably going to be spun off and come out of countries other than United States. I think a lot of developing countries are moving already to develop loads and control systems themselves. They will maybe import certain components, solar cell panels, et cetera, but I don't think they will be importing the whole thing.

Now, that might change the strategy for a lot of these producers and I think U.S. industry has been fairly savvy about this. There are few companies that are packagers and there are a lot of other companies, some of the bigger companies, that just have decided that they are going to sell the cells.

I know that Phillips of the Netherlands did a large number of studies, looked closely at photovoltaics competitions, and profit potential decided that the place for them to make money was in selling control systems. So, they got rid of their photovoltaics manufacturing facilities and they are just making the control systems.

Mr. **Gore**. You mentioned that the French have field experience but have had problems with technologies. Could you briefly tell us what lessons we might learn from the French experience?

Mr. **Bartlem**. The French COMES is a French Government agency under the Ministry of Industry. The French Government also owns, through the nuclear energy agency, CEA, a number of companies which produce renewable energy products. When it came time to launch the first overseas experiments these firms were the first ones to be given contracts. Among these experiments was a series of small solar thermal pumping stations. Because of poor technology choice, the pumps failed and incredible expenditures were incurred flying people back and forth to repair them. Nobody in the developing country could figure out how the darned things worked and how you repair them. Finally, COMES phased them out and replaced them with photovoltaic pumps similar to the ones manufactured in the United States.

In the first instance precisely because the French program was so dynamic and centralized, it was also unable to resist the political pressures of companies owned by the state. That was its major problem. I think that has been rectified now. They have diversified their lines a lot and they have some pretty good products.

Mr. **Gore**. Well, you know if you are out there selling and encountering problems you have an opportunity to learn. You have an opportunity to better calibrate your product to the market and evolve the production capability along with the market demand.

You, Dr. Ferber, have noted that some foreign efforts are much more oriented toward getting technology into the marketplace and capitalizing on contact with the customers.

We had a hearing all day yesterday on robotics and it is almost a sense of déjà vu today hearing what we are doing in solar and conservation compared to other countries because in the field of robotics they are concentrating on the applications part of the technology, getting it marketed and making it relevant to the needs that are presently there.

And it seems that we are making a similar same mistake in ignoring that strategy here in solar and conservation.

Would you agree, Dr. Ferber?

Mr. **Ferber**. It is my opinion that that is correct. I did give an example of the fact that the European EEC program is putting more than twice the funding into applications and market-oriented activities that they are in research and development activities.

The Japanese program is a little more evenly balanced between the two, but I think the same can be said there. In Europe and various member states in Europe and in Japan, the governments are very, very much near term applications support oriented and they work in various ways with the individual companies within the countries to foster early applications both domestically and internationally.

I gave some examples of what is happening in Italy outside the EEC program that are, I think, very exciting and give examples of what the Italian Government is doing to foster applications in that country. But, at the same time, these applications are all carefully thought out toward export as early as possible for this large international market that is perceived there.

Many countries and their PV industries are working in ways that will allow them to put into place in various Third World countries, either through associates or subsidiaries or local manufacturing capability. I think most all of the potential PV exporting countries realize that they will not achieve really large markets in Third World countries without having a local assembly capability of some sort. The export-import trade balance capability just is not there to just go out and buy it all from outside the country.

Mr. **Gore**. It seems that U.S. companies tend to orient their product development and marketing to the domestic market. That also puts them at a disadvantage in the world market, don't you think, Mr. Bartlem?

Mr. **Bartlem**. Oh, yes, that is definitely true. I can give you an example of a German company, Siemens. Siemens considers itself a world company and has developed. They have a series of worldwide application centers to study local uses for their electronic products. I know there is one operating in Brazil and one in Australia. They are trying to put two more, in southeast Asia and Africa. The applications companies do nothing but take Siemens products that are developed back in Germany and through a staff of research scientists hired from the local population, they do applied research. Siemens pays 100 percent of these costs and evidently from the feedback they have it is worth every penny they put into it.

Mr. **Gore**. It gets the word out.

Mr. **Bartlem**. They also many times make changes and alterations that make their product accepted as national. It is their product as well and so when it comes time to sell it all works much better. You also have the cooperation of developing country governments because they see that you are making an extra step to give jobs for their research scientists.

Mr. **Gore**. Is there any government money in those application centers?

Mr. **Bartlem**. Well, indirectly there might be because they get a lot of government contracts from the German Government, but I know it is almost all done on private capital.

Mr. **Gore**. Well, our companies better wake up. It is a world market now and things are changing rapidly.

Mr. **Ferber**. Mr. Gore, if I could add one thing to that. We do have significant activities that are somewhat related to that by a few of our American photovoltaic companies and one example I think of is Spire Corp. that makes photovoltaic manufacturing equipment. They are tailoring production packages for Third World nation installations and working with local agencies in many cases to customize to the local needs and then install such packages in these countries.

Mr. **Gore**. Dr. Ferber, do the Japanese have any silicon ribbon processes that compare with the Westinghouse or Mobil processes?

Mr. **Ferber**. Yes, sir, in the Japanese program and in the Japanese industry there are at least two ribbon processes being developed. One, mainly within the sunshine project activity and the other largely by private industry. The one that is being developed by private industry is through Japan Solar Energy Co. in cooperative agreement with Mobil Tyco. They are now manufacturing silicon panels commercially using the EFG process developed by Mobil Tyco.

And in fact, last year, about half of the commercial crystalline silicon module sales in Japan were using this technology.

Mr. GORE. How would the elimination of JPL's flat plate silicon array project affect the competitiveness of U.S. photovoltaic firms as compared to the Japanese and Europeans at the turn of the decade.

Mr. FERBER. I think the flat plate solar array project at Jet Propulsion Laboratory plays a number of important roles with industry. Clearly, in the past, the project has been structured to support both the near-term R&D needs of industry and the far-term R&D needs of industry in flat plate panel technology both silicon and otherwise.

Under the support that has been provided in the past, industry has felt that some of the most valuable portions of the LSA activity and those which under all circumstances should be continued are the things related to module durability and reliability and module design and engineering. The long-term test work that leads toward 20- or 30-year-module operational lifetimes is the kind of thing that industry just can't do on their own on an individual company basis. It must be done through an agency that has the capability to collect data from a wide range of sources, a wide range of experimental applications that we have in the field, assimilate this data, and analyze it and then work in the technology development area to understand what this data means and how we can use it to improve the technology to get the long life modules that are needed in the industry.

No one company is capable of doing this on their own and the major European programs and the Japanese program both have major activities in this area.

I believe if the U.S. program activity at LSA went away there would be no other agency in the United States that would be able to pick this work up and support industry directly as LSA has done. There are many other areas of technology that I believe also would be a severe loss to U.S industry if LSA went away and would cause, almost certainly, U.S. industry to lose its lead. We now have a very significant lead in technology in the United States as well as a lead in production capability. I think we would see U.S industry losing that lead to foreign competition within, at most, 3 to 4 years.

Mr. GORE. Well, what makes you so certain that private industry would not borrow the money at 17-percent interest and make this speculative effort on their own?

Mr. FERBER. What is the private industry? We have approximately 15 to 20 different companies now that are involved in flat plate module assembly and several others in concentrator module and array assembly. All of them have different interests, different corporate backgrounds, and so forth. There is not a monolithic direction in industry right now and if the industry did it on their own, each would do a different thing.

Each would see a different direction to pursue and we would lose the focused, coordinated direction that has been provided by the

DOE program through the LSA project. It is that focused, coordinated direction that I think is critical.

Mr. **Gore**. Well, I am trying to figure out what the administration is thinking. You don't see any State or local programs to do this, do you?

Mr. **Ferber**. Again we have 50 States in the United States. Perhaps 10 of them have significant photovoltaic interests which might provide support in one way or another.

Mr. **Gore**. What about civic clubs? Are there any civic clubs in it?

Mr. **Ferber**. I think we are really reaching.

Mr. **Gore**. Well, I am just trying to cover all the bases because it seems like a pretty stupid policy to me.

Mr. **Ferber**. I understand that. Actually, there are two organizations in the United States that are in the testing business commercially that could conceivably provide a part of this activity. If the Solar Energy Industries Association or some other organization of manufacturing companies got together, they could have the designated organizations perform this service as a structured activity. I am referring to organizations such as Wyle Labs or Desert Sunshine Test Laboratories.

Mr. **Gore**. Well, conceivably, American industry could figure out a way to do this on some basis, but the most sensible approach seems to me is to have a focused effort by working through the Government and have the Government play a leveraging role to single out the most promising avenues and get over the hurdle.

It seems like an intelligent way. Members on both sides of the aisle of this committee have long felt that.

What makes the Japanese certain that amorphous silicon is the winner among the photovoltaic technologies?

Mr. **Ferber**. Mr. Gore, let me address the first comment you made briefly and then go on to amorphous silicon. With respect to the industry possibly being able to eventually pull it together themselves, yes. I think that could happen eventually. The problem is that we are in a very strong horse race with the foreign competition and I don't think we have the time to get organized as an industry without government help.

Mr. **Gore**. We have got to have a focal point?

Mr. **Ferber**. Right, I think we have to continue a focal activity without interruption if we are to stay ahead in the horse race.

Now with respect to amorphous silicon, the Japanese activities and why they have focused their advanced research activities in amorphous silicon and whether that is the best long-term, thin-film technology or not that is hard to answer at this point. It is not clear to me that any thin-film technology will be the ultimate winner. Silicon technologies through ribbons and other crystalline silicon approaches could, because of the efficiency potential, have the long-term advantage for single junction solar cells. We don't know that yet. We don't know what the winners will be.

In the case of Japan, they are spending three-fourths of their photovoltaic budget on crystalline silicon technology right now most of their advanced research budget. The other roughly one-fourth, is being spent in amorphous silicon. They have realized, in the past with the smaller program and smaller resources than the

United States that they could not cover the whole waterfront, they have decided to focus on one technology which I think was a very smart move.

That does not mean that this one technology is necessarily the ultimate long-term winner. We don't know that. I believe other thin-film technologies may come along that could be better than amorphous silicon.

I believe that crystalline silicon through ribbon technologies, for example, could ultimately be the winner. There need not be any one winner long term. It could be that we will see, and I tend to believe this, that there will be significant market areas where amorphous silicon or some other thin film technology module will have the long-term market advantage. There will be other market areas where crystalline silicon will hold sway for the foreseeable future.

Mr. **Gore**. Both of you would agree that the Japanese appear to have singled out this industry and this future market as one of their prime target areas? Would you agree with that?

Mr. **Ferber**. Yes, sir, Mr. Gore, I do agree with that. Look at the total Japanese sunshine project [fig. 3] funding over recent years. It started out 3 or 4 years ago that the photovoltaic portion of the funding was a relatively small portion of the total sunshine project funding. In 1979, I believe, it was less than 15 percent of the sunshine project funding.

Today, it is the majority of the sunshine project funding. As they have worked with photovoltaics over a number of years they realized the potential of the technology and really ran ahead with it.

Mr. **Gore**. Well, it seems to me we ought to take note and reverse the direction that we are now heading in and that is the proposal to dismantle all our programs and just eliminate them. I really disagree with it.

Mr. **Bartlem**. Could I make one final comment?

Mr. **Gore**. Yes, sir.

Mr. **Bartlem**. I am not a photovoltaic expert. Photovoltaic cells provide a very premium product, electricity. The solar and the conservation field is very vast. I feel that there are other renewable technologies that have achieved cost effectiveness today, especially for developing countries. In other words there are products ready which don't have to rely upon high technology labs working day and night to come up with breakthroughs. Some of these other technologies have been developed with U.S. Government assistance.

The large windmill program, for example, has met and exceeded everybody's cost goals. It is pretty incredible when you look at what it can deliver today. Small windmills are also being employed as part of wind farms in California. That is going on today with today's money and at today's prices.

In the area of biomass, the United States because of its strength in genetic engineering technology, has a tremendous opportunity of pioneering energy production from plants. In other words I would like to see the programs that Congress considers to look very widely at these technologies and not to become too fixed with one particular technology when it does not necessarily fit into the world markets.

Mr. Ferber. Mr. Gore, I would like to reenforce Mr. Bartlem's comments. I am not implying that photovoltaic is the only renewable energy technique that should be pursued, but I do think we need to stress a continued balanced renewable energy program within the U.S. Government. There are many of these technologies that can be commercially exploited with just a little more help from Government programs and exploited very widely.

Mr. Gore. I agree with the comments of both witnesses and did not mean my comments to imply otherwise.

Thank you both very much and thanks to all our witnesses today.

We will have another day of hearings on this topic coming up on the 17th. Thanks for getting us off to such a good start.

The hearing is adjourned.

[Whereupon, at 12:55 p.m., the subcommittee was adjourned.]

U.S. SOLAR AND CONSERVATION TECHNOLOGIES IN INTERNATIONAL MARKETS

THURSDAY, JUNE 17, 1982

HOUSE OF REPRESENTATIVES, COMMITTEE ON SCIENCE AND TECHNOLOGY, SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS, AND THE SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT,

Washington, D.C.

The subcommittees met, pursuant to call, at 9:30 a.m., in room 2318, Rayburn House Office Building, Hon. Albert Gore, Jr., presiding.

Mr. GORE. The subcommittees will come to order. It is a pleasure to welcome all of you here this morning to our second hearing on "U.S. Solar and Conservation Technologies in International Markets." Chairman Fuqua was planning to be with us this morning but was unexpectedly called away. Chairman Doug Walgren is expected at the hearing shortly and I am delighted that we have the distinguished witness list that we do. As you may know this and the hearing scheduled for next Monday will complete the set of hearings initiated by the subcommittees on June 3, 1982.

The objectives of these hearings have been, and are: First, to assess the effects of changes in U.S. Government policies and programs in research, development, and demonstration and export assistance on the competitiveness of U.S. energy conservation and renewable energy technologies in international markets.

Second, to examine the status and future plans of European and Japanese RD&D programs in energy efficiency and renewable energy.

Third, to determine the adequacy of existing U.S. Government programs to promote the sales of American energy conservation and renewable energy technologies abroad.

Fourth, to examine the policies and programs employed by other industrialized nations in promoting their own export of these technologies.

The hearing on June 3 examined the level of commitment and the focus of the Europeans and Japanese. Testimony at the hearing established that the Europeans and Japanese, in direct contrast to the administration's policies, are maintaining their support of energy conservation and renewable energy technologies and in some cases increasing it. Projected funding patterns exhibited an increasing importance being attached to these technologies by these countries. The focus of the support was also in direct contrast to that of the administration. Whereas this country is now supporting only long-term, high-risk research, our foreign competitors are primarily supporting near-term research (maybe better termed development) which by definition is lower risk. These countries are applying a very pragmatic set of criteria when determining whether to support a particular line of research. Will the support increase exports? Will it reduce imports? Will it help create jobs in their country? Can the technology be commercialized within 3 to 5 years?

I am not sure whether we should take an approach similar to this but I am sure that the projected trends dictate that we give it serious consideration.

The hearing today and on the 21st will examine U.S. programs to support and promote the sale of U.S. energy conservation and renewable energy products in international markets. While these hearings are focusing on conservation and renewable technologies, it is apparent that many of the problems faced by these technologies are generic to small- and medium-sized industries who want to develop the export market. So necessarily we are having to examine some of those generic problems, and many of our witnesses here today will address these generic problems.

In addition, and perhaps much more important, there are some who believe that America is gradually losing its leading position in technology as a direct result of failing to develop international markets. The release of a report by the Congressional Office of Technology Assessment yesterday provides additional evidence of this trend, in another area that comes within the jurisdiction of the full committee, the area of space-related technology.

Isn't it shocking for Americans to hear that America may be losing its leadership in space? It would have been unbelievable a year or so ago, and it is now to many Americans, but again the failure to promote exports and the failure to cultivate international markets is directly related to this problem.

There are also those who believe that by complicating and not supporting the export technology we accelerate the loss of our technological leadership because we implicitly encourage licensing of our state-of-the-art technology overseas.

In summary, I believe these hearings will touch on issues which have far-reaching consequences, not only for the export of American technology, but also for the size of the domestic market and the state of the economy. The witnesses we have today will be testifying on these issues as well as what they believe should be done to assure successful access to international markets for small- and medium-sized American industry.

We are delighted to have as our first witness the chairman of the Subcommittee on Human Rights and International Organizations over at the Committee on Foreign Affairs, Hon. Don Bonker of Washington.

We are delighted to have you, Don, and, without objection, your entire text will be put in the record. We invite you to proceed.

STATEMENT OF HON. DON BONKER, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF WASHINGTON, AND CHAIRMAN, SUBCOMMITTEE ON HUMAN RIGHTS AND INTERNATIONAL ORGANIZATIONS, COMMITTEE ON FOREIGN AFFAIRS

Mr. **Bonker**. Thank you, Mr. Chairman. I would like to congratulate you for conducting these hearings. I believe they are timely, and indeed at a time when Congress seems to be consumed with budget deliberations it's good that at least one subcommittee is raising its sights and looking beyond the budget for ways in which we can bring about economic recovery at home by increasing our export opportunities abroad.

I am appearing in my capacity as chairman of the export task force and also as the sponsor of legislation that would create export trading companies. Mr. Chairman, we are in a fiercely competitive world economy, and the United States must find its place in that economy and compete effectively if we are going to have full economic recovery at home.

The fact is, other countries are becoming more aggressive in their marketing practices and their government policies to accelerate their place in the world market, while the United States sits idly by. Indeed, we find, through failure to implement the Export Administration Act, which authorizes the President to impose trade sanctions, and through predatory credit practices that are being carried out by other governments, we are placing our U.S. firms at a competitive disadvantage.

Not only do we lack incentives in place to make us more competitive, but we actually have placed a number of inhibitions and obstacles in the way of U.S. firms who want to and are capable of competing more effectively in the world market.

I think the Eximbank is just the one example. It's a program that makes it possible for U.S. manufacturers to compete on an equal basis with their counterparts. If we are to remove that kind of support without other countries doing likewise, there is no way that large corporations like Boeing or small companies who benefit in one way or another from the Eximbank, will remain active on the world market.

If we don't have Eximbank, perhaps we ought to have export credit subsidies that are targeted to those areas were we are competing with companies that are being subsidized through credit assistance by other countries.

But I would like to focus more directly on legislation that is pending before the House that would allow the formation of export trading companies.

Mr. Chairman, the Department of Commerce has announced that there are 20,000 to 30,000 U.S. manufacturers that today are capable of competing in world markets but lack the resources to be competitive. Export trading companies have proved to be very successful in Japan and European countries.

Indeed, almost all industrialized countries have trading companies which make it possible for their medium- to small-sized firms to get into the export market. We don't have anything that is comparable in this country. Instead, we have very rigid antitrust laws that make it extremely difficult for companies to come together for this purpose. We have a lack of financial capital which is necessary if smaller firms are to band together in order to compete more effectively abroad.

What the export trading company will do is remove the uncertainty and fear that is associated with current antitrust laws. Presently, if three or four or five companies want to come together for the purpose of promoting and marketing products abroad, they are incapable of doing so because of the potential threat of violation of antitrust laws.

What this bill will do is provide a certification that companies fill out and submit to the Department of Justice which would give them immunity from possible antitrust violations.

Of course, we want to make sure that that immunity applies only to the international market and not to the domestic market and those provisions are explicit in the legislation.

Second, it would allow banks to participate indirectly in the formation of trading companies. Currently those companies that want to compete lack the financial capital to do so. Banks are interested in getting more actively involved in trade, but up until now there has been a pretty solid wall between a bank's depository functions on the one hand and commercial activities on the other.

The legislation that is pending before the Banking and Currency Committee would allow banks to participate through holding companies or corporations. In that manner they could provide the financial capital that is necessary for the formation of trading companies.

My biggest concern with the legislation is that we attempt to develop provisions that would encourage the smaller regional banks to get involved and not just the big money center banks on the east coast. But, nonetheless, the experts in the trade field have testified before various committees that this export trading company legislation, if it is enacted by the Congress, could do wonders for our domestic economy by opening up new markets abroad.

I think it would serve as a catalyst, if you will, to raise the consciousness among American businessmen who have been looking too much to the domestic market to meet their growth needs without attempting to compete on the world market.

When it comes to the particular subject of solar and conservation technologies, I think the United States, as it has been in the space industry, certainly is in the forefront. I think it is an area where we can be competitive internationally. We have the technical knowledge. I think we have the resources necessary to compete effectively in the world market, but, unlike many other industries that have been around for a long time, especially multinationals that have all the resources to compete effectively in the world market, this is an infant industry. It is not a large corporate empire. It is made up primarily of smaller, very innovative manufacturers. So I think passage of the export trading company bill would do a lot to enhance their competitive position in the world market.

The legislation, for the chairman's information and for those here who may be following the issue, has been assigned to three separate committees. Two full committees have now acted favorably on export trading company legislation.

The Banking Committee, as I understand it, will be marking up next week and at that time we ought to move directly to the House floor. The legislation has passed the Senate on two occasions: once the Democratic Senate by vote of 92 to 0, and then last year the Republican Senate by a similar vote.

So it is a bill that is supported by almost everyone, and I expect no problems on the House side. We should have that export trading company bill signed into law sometime before we break for the summer recess.

Mr. Chairman, I would be happy to answer any questions.

Mr. **Gore**. Well, thank you very much, and thank you for your leadership in the export task force, and on this complex of issues generally. I know I have been getting letters from you for many years pointing out these and related problems, and there are many among your colleagues who appreciate your leadership in this area.

What is the difference between your legislation and the version that is passed in the Senate?

Mr. **Bonker**. Well, both bills have two major provisions, one that deals with antitrust laws and the second that deals with banking provisions.

The Senate provides, I think, a more liberal immunity from antitrust laws and actually has the Department of Commerce administering the certification procedure.

The Judiciary Committee was not at all anxious to have Commerce oversee what is essentially a Justice Department function, so we eventually reached a compromise where the Justice Department would have review authority over the certification procedure and would issue the approval or rejection of the certification application.

But the Department of Commerce would still be the lead agency. So the fundamental difference is who administers the certification procedure. The Senate would like to see the Commerce Department do it; the House the Justice Department.

The same with respect to the banking provision. The Senate, I think, has more liberal application of those procedures by allowing banks to participate directly in the formation of trading companies where the House language requires that participation be made through holding companies or corporations. What we want is a management entity between the bank and the trading company.

The Federal Reserve Board would be the final authority on the banking provision in the House language. In the Senate, the Federal Reserve Board along with two or three other Federal agencies are involved. Frankly, Mr. Chairman, I think the House has put a lot more work into this legislation and we have come up with a better bill, but those things will have to be reconciled when we go to conference.

Mr. **Gore**. Well, thank you very much.

I recognize Mr. Walker.

Mr. **Walker**. Thank you, Mr. Chairman.

First of all, I have an opening statement that I ask be included in the record.

Mr. **Gore**. We will include that.

[The opening statement of Mr. Walker follows:]

OPENING REMARKS OF REPRESENTATIVE ROBERT S. WALKER

Mr. Chairman, the issue before the Committee today is one with serious, and troubling policy implications.

There are a number of valid arguments on either side of this issue. Those who would advocate totally free and open trade with the world of advanced American technology advance the argument that, after all, we do not exist in a void, and if America will not trade, our allies generally can, and will, provide whatever other nations want. This argument assumes that our allies will not adopt parallel policies when we want to impact on an internal political policy of a third nation.

Unfortunately, this argument has substantial merit. As we have seen in recent months, our efforts to effect a change in Soviet policies by refusing to grant licenses to sell a substantial amount of equipment they need for their new gas pipeline have been generally ineffective. This is because the Soviets have been able to procure pipe handling equipment from Japan, and pipe supplies for the project from Italy.

This is merely an example, but it seems a good one. Even our strongest Western European allies, such as West Germany, feel that they must respond in their own best interests and contract with the Soviets for gas to be delivered through the new pipeline.

What we should learn is that we cannot dictate policies to our allies in many areas of trade. And since we cannot, then we must also accept that trade sanctions may not be effective.

But there is another side to the trade sanction coin. And that is that we are often faced with the problem of finding ourselves as a nation in a position where we must find some appropriate response to the actions of other nations.

For better, or for worse, America is in a position where we are the leader of the western world. That position of leadership carries heavy rsponsibilities and duties. One of the most important of those duties is setting a moral and statesmanlike response to provocations from other nations who take a course that the rest of the world condemns.

The previous administration placed an extraordinarily high priority in responding to the issues of human rights violations. But, as a wise man once said, "No man is an island, No man stands alone." It is our place in history that as part of our heritage as free men we have an obligation to speak out against tyranny. We have an obligation to not accept aggression. We cannot stand idly by and say nothing when men commit genocide.

Today we live in a world where gunboat diplomacy is no longer acceptable. And the superpowers cannot use military force to impose solutions without accepting risks that may well be unacceptable. Se we are left with a limited number of ways to respond when it becomes necessary. There are diplomatic responses, but they seem to have lost much of their impact in recent years. We can respond through the United Nations, but that seems useless in most cases. Or we can adopt appropriate trade sanctions. And while they often seem to lack the impact we would prefer, in many cases, particularly in the technology arena, they remain the most effective way for us to express our policies in a way which the world can understand.

Mr. WALKER. Just one question, if I could. What impact would this legislation have on our ability to prevent technology transfer at a time when we decide that an embargo on technology is needed in order to emphasize a political point?

Mr. BONKER. Well, this legislation merely allows the formation of export trading companies. When we get into the embargo of high technology commodities, that comes under the jurisdiction of the Export Administration Act, which authorizes the President to impose export sanctions for foreign policy, for national security reasons, oftentimes for materials in scarce supply. But it is that device that the President uses to determine whether or not the transfer of technology or the sale of certain commodities might compromise or represent a threat to our national security interests.

Mr. WALKER. And there would be nothing in this new law which would override any provisions of present law in that regard?

Mr. BONKER. No. This bill consists basically of three sections: One concerns the antitrust provisions; second, bank participation;

and third allows the establishment of an Export Trading Company Office in the Department of Commerce. I had several other provisions in the bill which we have taken out, one of which would allow risk tax benefits to trading companies, another which would allow the SBA, the EDA, if it is still remaining, to provide loans for companies that wanted to form trading companies. But to help expedite action on this legislation we removed those provisions.

Mr. **Walker**. Thank you, Mr. Chairman.

Mr. **Gore**. Mr. Dunn?

Mr. **Dunn**. I'm sorry I wasn't here for your opening statement. One question. This legislation is geared to small businesses that don't have the expertise to deal with foreign countries. Is that the idea, to help them come together?

Mr. **Bonker**. It really has no limitation with respect to size. In fact, Burlington Northern, which is a large organization, is thinking about setting up an export trading company. I rather imagine large corporations would be very interested in this issue for a variety of reasons, but the idea behind it is to help facilitate the export of U.S. products by small- and medium-size manufacturers who right now lack the facility, the resources, the know-how to get into that market.

I come from the Northwest, and we can be competitive in the wood products industry. Indeed, Weyerhaeuser and larger corporations are very effective in the world market, but the smaller mills just don't have the capacity, even though they have a product to get into that market. But if four or five of them can form together, then they can set up a trading company that would help with marketing techniques and other ways to distribute their products on the world market.

Mr. **Dunn**. In terms of capacity, I take it you mean they don't have either the expertise in-house or the money to pay for that expertise to go out and arrange it?

Mr. **Bonker**. Yes. A lot of them go to export managers and there are various ways of facilitating it, but I think if we are going to get into the world market in a more serious fashion, we have to remove the impending threat of antitrust violations. It scares these people to death whenever three or four companies come together for that purpose. Also we need the financial capital. You can't get into that market until you get some money to facilitate the exports.

Mr. **Dunn**. I thank the chairman.

Mr. **Gore**. Thank you, Don, for excellent testimony.

Mr. **Bonker**. Thank you, Mr. Chairman. I hope all of you will support the bill when it comes up on the floor.

Mr. **Gore**. Our first panel of witnesses consists of Donald Stingel of Germantown, Md., and Erland Heginbotham, director for Asia, International Information Reporting Systems in Arlington, Va.

Gentlemen, I want to welcome you and tell you that I've really been looking forward to this panel. I have read some of the work that you have done and I have a feeling that those who have not heard your views before are going to find it an eye-opening experience. I think both of you have a great deal to offer our country.

Mr. Stingel, you were the only graduate engineer to serve on the Ex-Im Board, if I am not mistaken, and also the former director of the Eximbank. And, Mr. Heginbotham, if I am not mistaken, this is the first time you have offered your full views free of the constraints that various government positions in the past have imposed upon you. We are looking forward to very candid testimony from both of you.

We will take your statements and save questions until both of you have finished. Mr. Stingel, we will begin with you. Without objection, the entire text of your prepared statement will appear in the record, and you can proceed in any fashion that you see fit.

STATEMENT OF DONALD STINGEL, GERMANTOWN, MD., FORMER DIRECTOR OF THE IMPORT-EXPORT BANK

Mr. STINGEL. Thank you, Mr. Gore. I appreciate being asked to be here today because my work experience over the years has involved a great deal in the export market. I have built plants around the world and, as a director of the Export-Import Bank, have helped finance and support about $50 billion of U.S. exports. What concerns me deeply, however, is the fact that the United States has really lost its leadership in world trade.

Many years ago the United States was a source for most of the technology that the Japanese have taken today, for example, and developed to a high degree, added many quality controls to it, and now are, in effect, selling that technology back in this country and in other countries of the world. Not only the Japanese but the Germans, the French, and other Europeans.

I have basically four reasons why I think we are at risk in the foreign market, and I would like to go into these in detail to some extent, diverting really from my written testimony and giving you basically some examples of each of those points.

In the first place, a foreign customer or U.S. supplier can never be certain even though an export license has been granted by the Commerce Department that he is actually going to be able to complete his contract and ship the goods that were ordered by the foreign buyer. This has made many foreign buyers very uncertain of U.S. technology and U.S. equipment sales.

There has to be a more practical way for intergovernment agencies such as Commerce, State, and the White House, for example, to get together at an early date before a lot of money is spent by U.S. bidders to determine whether or not there is going to be some political reason or other expedient, why something will be withheld on a particular contract.

And in my written testimony I give the example of the tool bit plant that was designed for Russia for drilling oil wells. This was a case where I was personally involved because my company did the basic engineering for Dresser Industries on this job. Dresser provided the technology and at the last minute, in the Carter administration, after most of the equipment had been shipped except a few key parts, the White House decided that the balance of the equipment could not be shipped because it involved an electron-beam welder and other technology, which it turned out after investigation was available in seven other countries of the world including East Germany, maybe not quite as good as ours, but available, and could have done the job.

This is the kind of thing that I think keeps the U.S. bidder on edge because he never knows when the rug is going to be pulled out from under him.

I would like to say, too, that today in all of the areas where we have the big capital goods exports—and I don't mean just from small- and medium-size companies but I'm talking about aircraft, steel mill equipment, chemical equipment, metallurgical equipment, and so forth—the other fellow can build it just as well and sometimes better than we can.

Often Americans think that we are the only ones that hold technology in certain areas. For example, Boeing technology was mentioned earlier here, Boeing operating mainly in the State of Washington. Boeing has come out with a very modern new aircraft which is going to save fuel by decreased fuel consumption. But who came out first with such a new design, the French, with the A-300, and finally the A-310? Their new plane flew before our plane, and they are selling those planes in direct competition with Boeing, in the world marketplace. This is just one example where we do not have leadership, in my opinion, anymore in the technology that provides many American jobs, and that is why we have got to regain that leadership.

The second major deterrent and one that I am most familiar with is the lack of adequate, truly competitive financing by the Export-Import Bank of the United States. A recent survey was completed by the Machinery and Allied Products Institute, which has done a lot of good work in this field. It surveyed 39 industries in this country and found that we were losing many export opportunities because of inadequate financing.

In other countries of the world, an exporter can count on his government bank, or his government subsidy, or whatever you want to call it. For example, he can count on COFACE in France, he can count on the ECGD in England, the Japanese can count on MITI, and they don't have to write a long story ahead of time and convince their export-import bank, or whatever they call it, that they need financing to support an export.

They can count on it automatically and they know exactly what the rates are going to be and what the cover is going to be. It does not matter whether it is a large capital goods export or a medium or a small capital goods export. They are all treated in the same way. They normally get 85-percent financing and they get whatever OECD interest rate has been agreed upon between the OECD countries, or better.

Here we give large capital goods exports financing as project financing, but the small- and medium-size company exporting a single piece of equipment, for example, must depend on insurance or guarantees or discount loan programs which really throw them into the commercial rate market and he simply can't compete because he may be as much as 5, 6, 8 percent higher than his competitors. And when you compare interest rates over a period of 10 or 15 years with price, interest cost becomes a dominant factor in a sale.

I do not believe that this administration, or the previous one, really understands the nuances of trade, and they content themselves with trying to get minor concessions, for example, from the

Japanese or attempt to impose duties to prevent dumping or something like that. I think, basically, our Government ought to look at its whole export picture and find out why we are languishing in our exports as compared to other countries and really get into a basic study of the problem. I will cover a couple more of those points.

Why, in fact, are we buying steel mill equipment now from Italy? Why are we having Japanese engineers come in and show us how to run our own steel mills, providing equipment for those steel mills and many other industries? If you go, for example, to a textile trade show in South Carolina, in Greenville, which is held once every year, you will find about 10 percent U.S. equipment and 90 percent Japanese, German, French, and British equipment dominating the show. Why? Because we have not supported our technology. We have not provided adequate financing as other countries have done.

And there are often cases when a U.S. supplier cannot sell at a particular time, such as when our economy is down as it is today in this country, and in order to spend money for R&D he must make foreign sales, and these foreign sales must be supported by financing or he simply is not going to make them.

A third problem with export of technology, equipment and so on from the United States is our interpretation of the antitrust laws. For example, we simply can't get five American companies to sit down together and each one take the best part of a job that he is best qualified to bid and share the risk. They simply can't get together.

They are afraid of the law and therefore if they want to bid, each of the five in this example would have to go out and spend the money to make his own bid, and not only does he end up with foreign competition but each one of them ends up with four domestic competitors.

I would rather get a part of a job and know that I was going to have a good chance at it than lose out altogether because I was competing with so many extra domestic competitors and had to spend all the extra money to do so.

Other countries don't worry so much about this. I tell you one from my own experiences. When I was at the Export-Import Bank we were competing strongly for the expansion of the telecommunications system in Korea. This was a $1 billion job which would eventually become a $2 billion job. The only U.S. bidders were GTE and the Western Electric Division of AT&T.

The competition was the French, the Germans, and the Japanese. Here was a case where the other countries pretty well designated who would be the bidder. The Japanese actually had three bidders in this particular race. But when the bids were open, one of the bidders was low for the Japanese and the other two were exactly $100,000 higher on a $1 billion bid.

Now, this is a case where the Japanese Government really, in effect, can select the company that will go in and be the bidder, so therefore all the other companies can either bow out or just stick a price in that really does not mean anything. They know they are not going to be the effective low bidder going in. We cannot do that.

I can just see us having GTE and Western Electric sit down together in the same room and try to each take the best part of a bid to compete with other countries of the world. No, they had to each spend a number of millions of dollars to make separate bids in competition with each other as well as the foreign bidders.

But this was one case where financing really did not enter into it because the United States in this one field of telecommunications still is superior to the Japanese, the German, the French, or any of the other countries of the world. AT&T won that job with the help of the Export-Import Bank but with an interest rate that was considerably higher than the interest rate provided by the other countries.

I might add, too, that while we think everyone is following the OECD consensus among the 22 trading countries in the world that all are signatory to the consensus, this is not always true. This Korean case was a case where the Germans, for example, at a time when interest rates were 7¾ percent minimum bid 7½ percent for 20 years against a 10-year OECD limit, on a private letterhead, and the German Government simply had to support that company that offered the private letterhead financing. The Japanese, at the same time, signatory to the consensus, offered 6-percent financing for 20 years, and I was able to get copies of both of those quotes from the Korean Government, so I know that this was so.

I can't prove that the Japanese Government and German Government were behind these bids, but it is obvious in a $1 billion bid which could end up a $2 billion bid, someone has to support a company when their prices were quoted quite low and they were not only low in competing on price, they were low in competing on financing.

But this is the one case that I know of in the bank in my 3⅓ years there, one big case that I know we won because of superior technology. I can't think of any other such case except a minor one perhaps that we also won because of superior technology.

I hope, sincerely, that the Export Trading Company Act will pass the House. It's long overdue. It may not solve all the problems but it will at least allow some companies to get together, share the risks, and begin to find a way to best bid a job where each can put in his best part and try to win the job from foreign competition.

If it does not work at the beginning, we can certainly make it work. We change the laws in the United States quickly enough that we can adjust to a bad situation if it turns out to be that way. I think we have worried too much in the Export Trading Company Act about banks becoming involved and I think they have to be involved to furnish the financing for some of these packages.

Mr. GORE. Mr. Stingel, if you will forgive us, we have a vote on the floor and it won't take more than 6 or 7 minutes. We will recess and then pick up with your testimony.

Mr. STINGEL. Fine. I just have one or two more points and I will hold them.

[Recess.]

Mr. GORE. The subcommittee will come back to order.

Mr. Stingel, please proceed.

Mr. STINGEL. Mr. Chairman, thank you. I know I have used probably my quota of time.

The fourth and final reason I will cite in this testimony for our having problems in exporting technology compared to our foreign competitors is the overly strict interpretation of the U.S. Foreign Corrupt Practices Act. This act has had a damaging effect on U.S. sales efforts abroad, alhough no one wants to admit it and there cannot be any definite way of measuring how much business U.S. companies have lost as a result of the act.

I can say personally that before I got into Government I had many opportunities to sell overseas. Several times I got into a situation where I knew I was the low bidder. I knew that I would meet the delivery time. I knew I had the technology and could produce the plant and the product, but at the last minute I was told, so sorry, the job has been given to someone else.

I suspected the reason, that it's always something that's very difficult to prove. I do not believe—and I hate to keep picking on the Japanese—but I do not believe the Japanese, for example, are great inventors. I respect them, however, as great innovators who have licensed technology from the United States and other countries of the world, have improved that technology, have patented the improvements and relied on quality to produce good products, automobiles, machine tools, any number of things. But I also know that something else goes on besides good quality and other things of this type, and competitive price and financing.

Again, I do not put the word bribery on it, but there are other inducements, certainly, offered by the Japanese and by other foreign competitors that we cannot offer. I think the United States is wrong in inhibiting our suppliers of capital equipment from at least paying reasonable commissions to people who would assist us in making foreign sales.

I don't mean commissions that are used to bribe government officials and things like that, but that still goes on today, and unfortunately the morality of the rest of the world is not the same as our morality. I think that is a very touchy subject but I think the Foreign Corrupt Practices Act has to be looked at a lot more carefully. We are losing a lot of business and we are never going to know how much business we lost because no one is ever going to say that they were the briber or the bribee, and I am being very frank about it.

The last point I want to make, specifically on the export of U.S. technology relates to energy conservation. I have written a couple of papers for the United Nations, and so on, wherein I have made the point that I think the United States should do everything possible, whether it would be by financing, providing technology, equipment, or otherwise to increase the world's pool of energy, particularly in relation to renewable energy sources such as solar, hydro, methane recovery, and so on.

It is a shame that this country has only one supplier of hydroelectric turbines left in the United States. All the others have gone out of the business because they simply cannot compete.

About a year and a half ago, bidding against the 17 other bidders in Argentina for the Yacreta power project on the Parana River, Allis-Chalmers was the only company able to compete because they are the only ones that make water-wheel turbines today in the United States. There are probably many opportunities for small manufacturers of turbines in the 1, 5, and 10-kilowatt range, low head, high head, low flow, and so forth.

But if we get people interested in this business and get them to spend the money on R&D, we must certainly provide them with financing to compete with other countries of the world because if they go into the Export-Import Bank today, the only financing they can get is really guarantees or discount loans which really give them a commercial rate, as I mentioned earlier, and they simply can't compete with other OECD nations which can provide this equipment and which will give them financing at anywhere from 10 percent to 11 percent, which are the OECD rates today.

In other words, other countries, again, do not distinguish between large capital goods exports and small capital goods exports, as we definitely do, and we discriminate against the small and medium businessman in that respect.

We never did find a solution to this problem while I was a director of the Eximbank. We always were under constraint as far as our total budget and money available was concerned, and it was quickly used up in financing large capital goods exports with nothing left over for those from small and medium-sized companies.

I don't think the United States is out of the trade market, but I think it has to do a lot more to effectively win export contracts, I think the Congress has to do a lot to straighten out some of the laws that inhibit trade. I think we have to take a different look at our financing practices. We have to realize that maybe we are subsidizing financing in the Eximbank to some degree by offering interest rates below market, but is this really bad.

On the other hand, we have to take into account the contributions of added employees to the social security system, the earnings that are taxed as profits, and provide revenue to the Treasury and all the other benefits that come from increasing jobs in the United States by increasing exports.

[The prepared statement of Mr. Stingel follows:]

Testimony of Donald E. Stingel

at a Joint Hearing of the

Subcommittee on Energy Development and Applications,
and the
Subcommittee on Investigations and Oversight,

U.S. House of Representatives

9:30 AM June 17, 1982

Room 2318

Rayburn House Office Building

I appreciate being asked to testify before this hearing of the joint committees on the subject of promoting U.S. technology abroad as I have been quite concerned that U.S. firms are at a decided disadvantage in developing overseas markets for their technology for a number of reasons as compared to the Japanese or European firms with which they compete in the world marketplace.

Before expanding my thoughts further I do want to say that over the years I have testified before a number of committees and subcommittees of both houses of Congress as a Director of the Export-Import Bank of the United States and before that as the head of a major U.S. firm engaged in engineering and constructing manufacturing plants in many countries of the world including Iran, Russia, Poland, Saudi Arabia, Argentina and Brazil, to name a few. Never have I seen more foreign competition than today, or the need for closer cooperation between the U.S. Government and U.S. industry rather than a generally existing adversary relationship which is diametrically opposite to that enjoyed by our foreign competitors.

I might also add that this is the first time I have ever testified that my views are totally unrestricted - by the Executive Branch while I was a government employee - or because I was trying to make a point to help my particular industry when I was in the private sector. My only interest now is in seeing that the U.S. position in world trade does not deteriorate further and that my fellow Americans do not suffer further loss of job opportunities, and our country again recovers its once usual prosperity.

There are four (4) key reasons why U.S. firms have difficulty in competing abroad, whether they be small, medium-sized, or even large companies selling technology, engineering, technical products, or integrated plant facilities combining all of these.

First, a foreign customer or a U.S. supplier can never be certain, even though an export license has been granted for the sale by the U.S. Department of Commerce, and a valid contract signed between seller and buyer, that subsequently this approval might be revoked by our government for strictly political reasons. I will relate two recent examples of this, one in the Carter Administration and one in the current one. During the Carter era Dresser Industries of Dallas, Texas, made an agreement with the U.S.S.R. to provide technology and equipment to establish in the U.S.S.R. an oil well drill tool bit plant to enable Russia to increase its oil exploration and hopefully its proven oil reserves, certainly a plus if it would help keep Russia better supplied with oil from internal sources. The plant equipment was almost completely shipped when the U.S. government, which had initially decided in favor of the export license, suspended exports over an argument involving the question of whether or not electron beam welders should be part of the deal or were they too highly technical for the U.S. to export. They were essential to the job and did finally go forward but only when it was shown that seven (7) other countries, including East Germany, made such sophisticated equipment. Months of uncertainty and greatly increased project costs resulted from this delay based on misinformation and lack of cooperation between government and industry in the U.S.

The second example is the no longer existent opportunity for U.S. firms to sell large gas compressors, pumps, regulators and other equipment to enable Russia to transport natural gas to Western European countries. Technology certainly exists in Germany, France and other European countries, as well as Japan, to provide every item to complete this project so the U.S. loses out, even though in this instance our technology in some areas pertinent to the purification, compression, and transportation of natural gas is to date superior to that of other countries, but their equipment is certainly adequate to do the job.

The second major deterrent is the lack of adequate, truly competitive financing by the Export-Import Bank of the United States. This Administration makes it very difficult to get a high percentage of loan cover or rates which will match those of competitor OECD nations selling the same or similar technology or product. Where other nations offer almost unilaterally 85% loan cover after a 15% cash payment, and interest rates ranging from about 10% to 11.25% depending on whether a customer country is a developing nation or underdeveloped, the U.S. insists on a flat 12% interest rate, plus a 2% up-front, one-time charge, and attempts to hold loan cover at 65% unless the seller is willing to underwrite 10% cover, then the Bank may go up to 75% cover. What I have related are the terms for generally large project financing. Small and medium-sized companies, particularly those selling only technical components, not a complete project, are relegated to the Bank's Discount Loan program or merely to insurance and guarantee coverage which results in higher commercial loan rates which are uncompetitive. Our OECD competitors finance about anything, large or small, at the same loan cover and interest rates. Furthermore, in countries like England, France, Germany, and Japan, for example, government financing is so nearly automatic that a deal is often made between supplier and foreign buyer before contact is ever made with the supplier's government financing agency. In other words the purpose of the government financing in the first place - to support that country's exports to the utmost - was and is being met, whereas ours is not competitive and cannot be counted upon.

A third problem with export of U.S. technology and related equipment involves our interpretation to date of anti-trust laws as relates to potential cooperative efforts between or among U.S. companies which could benefit by joint bids and sharing of risk in export sales proposals. There is no clear-cut way, for example, that GE and Westinghouse, or Western Electric and GTE, can sit down together and jointly bid a job to a foreign country where each could put into the bid its best technology at its best price without running afoul of the U.S. government.

In Japan, on the other hand, the Japanese government has been known to preselect a company or even the members of a consortium all from the same general industry to each take the part of a bid for which it is best qualified, thus saving tremendous amounts of bid costs and lost motion. In the U.S. today five suppliers, for example, each having the same or similar technology could each be required to go to the expense of preparing a competitive bid, plus taking on the heavy travel expense and other costs inherent in the sales and followup effort to sell to a foreign buyer. Not only do each of the five in my U.S. example have to worry about the pricing of his foreign competitors but about his four U.S. competitors as well. Not a very efficient way for the U.S. to do business! Furthermore the U.S. government cannot tout the merits of any one U.S. supplier but must support each and every bidder so the end result is not very much support for anyone. In the meantime the foreign competitor often has his government representative sitting shoulder-to-shoulder with him in negotiations with the prospective foreign customer. The Export Trading Company bill which has passed the Senate sometime ago, but languishes in the House, could effectively help potential U.S. suppliers of technology and equipment, especially small and medium-sized companies which would now necessarily pass up many foreign bid opportunities because of the aforementioned reasons, mainly cost, by allowing them to band together in making and following up joint proposals and enable the sharing of risk. I so hope this bill becomes law before we lose more ground to foreign competition! It certainly is worth a try.

The fourth and final reason I will cite in this testimony for our having problems in exporting technology vis-a-vis our foreign competitors is the overly strict interpretation to date of the U.S. Foreign Corrupt Practices Act. This Act has had a definite dampening effect on U.S. sales efforts abroad although noone wants to admit it and there cannot be any definite way of measuring how much business U.S. companies have lost as a result of the Act. I do not believe in bribery any more than the members of these subcommittees do, but I know from past experience that reasonable and adequate sales commissions are often necessary in accord with foreign country custom to go through all the procedures necessary in some countries to get the proper attention for one's bid, or to even be listened to. I also know from my days in industry that I lost a number of jobs for no apparent reason to a foreign competitor when my price was the lowest, my delivery time was in line, and the terms and conditions outlined in my proposal were thoroughly adequate, but nonetheless at the last minute I was told "so sorry" and I suspected but naturally could not prove what happened. The Act itself is definitely working against our export potential and needs relaxation to a degree, but above all a clear interpretation of what a U.S. bidder can or cannot do. The U.S. Secretary of Commerce recently asked several U.S. companies to explain in detail specific export opportunities lost because of the Foreign Corrupt Practices Act. This is impossible because if there is a "payoff" by a foreign competitor to a foreign buyer who in the world would knowingly make this public knowledge? I think we have tried to impress the the rest of the world with our high standard of morality enacted into the laws of the land and have not made any impression at all. Our competitors still resort to this sales tool as necessary and its use is widespread!

Before I close I do want to say a few words specifically about export of U.S. technology concerned with energy conservation and renewable energy systems such as solar, hydro, and methane recovery from incineration of refuse or other matter. For the reasons cited above we have difficulty selling such technology to potential foreign customers and without foreign sales and profits therefrom,U.S. R & D efforts and expenditures will necessarily be restricted without U.S. government support of some kind. On the other hand in Europe and Japan all-out efforts are being made to support such export sales, including such items as tiny direct-drive water-wheel turbines, small package incinerator units where a usable gas results by burning in the near-absence of oxygen, and so on. Without a clear-cut Federal policy of support in specific terms U.S. export sales of such items will continue to languish. Anytime the supply of energy anywhere in the world can be enhanced by the sale of U.S. technology, this is bound to have some small, but favorable impact on the U.S. so we should do everything possible to further such sales.

If there are any questions regarding my testimony I will be happy to answer them orally or later in writing. Thank you for your attention and again for the invitation to testify on these important subjects.

BRIEF CAREER RESUME - DONALD E. STINGEL

Donald E. Stingel, a Republican, was nominated by President Carter as a Director of the Export-Import Bank of the United States on October 7, 1977, and sworn into office on November 14, 1977, after unanimous confirmation by the U.S. Senate. Mr. Stingel had the distinction of being the first graduate engineer and one of the first business-oriented directors of this 46-year old independent agency. He resigned from the Bank August 4, 1981.

Prior to joining Eximbank, Mr. Stingel was President of Pullman Swindell of Pittsburgh, Pennsylvania, a company engaged in the engineering and construction of steel mills, foundries, glass and ceramic plants, and public works projects both in the United States and abroad, with projects active in more than 30 foreign countries.

Prior to joining Pullman Swindell in 1969, Mr. Stingel was employed by the Airco Corporation as president of its National Carbide Division from 1965 to 1968 and additionally became president of its Airco Alloys Division in 1968.

From 1946 until 1965 he worked for Union Carbide Corporation, first as a metallurgical engineer in one of its plants and later serving as assistant and division works manager in New York City from 1955 until 1965, having responsibility for all ferroalloy operations in the United States.

Mr. Stingel was born in Pittsburgh, Pennsylvania, on January 31, 1920, graduated from Carnegie-Mellon University in 1941 with a degree in metallurgical engineering. After a brief 6 months training period with Union Carbide in 1941, he was called to service as a reserve officer in the United States Army and rose through the ranks from Second Lieutenant to Lieutenant Colonel by 1946, serving both in the U.S. Army Ordnance and Transportation Corps.

Mr. Stingel is a member of the Board of Trustees of Carnegie-Mellon University, a member of the Board of Advisors of the Duquesne University's School of Business Administration; and before joining Eximbank was a member of the Commerce Department Advisory Committee on Multilateral Trade Negotiations, and Vice Chairman of the Commerce Department's Committee on East-West Trade.

He resides with his wife, Rita, at 14701 Spring Meadows Drive, Germantown, Maryland 20874 (phone 301/977-6400).

June 1982

Mr. GORE. Thank you very much. That was extremely interesting testimony.

STATEMENT OF ERLAND HEGINBOTHAM, DIRECTOR PACIFIC ASIA INTERNATIONAL INFORMATION REPORTING SYSTEMS, ARLINGTON, VA.

Mr. HEGINBOTHAM. Thank you very much, Mr. Chairman. I welcome and appreciate the opportunity of being able to talk to you this morning. I feel the committee has focused on the cutting edge of a very critical issue and I commend the committee for focusing on this topic.

You have pointed out and it seems ironic that the United States is in danger not just of growing balance of payments but even risks losing its lead in advanced technology.

Several years ago when I was Deputy Assistant Secretary of State for East Asia, we conducted a massive study throughout Asia of U.S. export competitiveness. Our findings were extremely upsetting. We found that, apart from those areas of technology where we were still very strong, in practically all other aspects U. S. export competitiveness was suffering severely.

It used to be enough to worry about the growing U.S. balance-of-payments deficit. Now increasingly we face jeopardy as well to our technological lead in the world and even increasingly, to the survival of important U.S. industries in the domestic market.

You have only to read the Wall Street Journal on a continuing basis to see the extent to which our industries are being bought up by foreign leaders in technological fields. Nowhere is this more critical than in the high technology industries. It is my belief that in the remainder of the 1980's and the 1990's the very industries which will form the core of progress by the major industrial nations are precisely those that face the greatest jeopardy in this country.

We retain areas in most industries, the lead in developing new technology. We are losing it in some areas, Where we are losing out heavily, however, and where our industries are risking loss of survival, is in the application and the export of these technologies.

I don't want to fall into the trap that was pointed out in the opening of a recent Wall Street Journal article. It began with a brief story about two foreigners who had been captured by a revolutionary junta in a small country. One was an American and the other a Japanese, and they were trying to decide which one would be executed first.

The Japanese gentlemen said, well, he would like to be last because he would like the opportunity to give a brief lecture on Japanese management. The American pleaded to be executed first because he said he did not think he could take another lecture on Japanese management.

I don't want to bludgeon that, but the fact is that the Japanese have employed in international markets as an international strategy, a technique which is devastatingly efffective. They have used a learning curve strategy which permits them to apply a mix of American technology, their own technology, and their own innovations at an exceptionally rapid rate and to gain special advantage from the faster reductions in cost and improvements in product which result. By the time the Japanese begin to compete in the U.S. market they have already achieved cost reductions and product improvements which are so beyond our own companies in many fields that there is no way for our companies to hold their share, even in the U.S. market.

These successes result from a strong Japanese focus on the fastest growing markets and from their ability to use debt financing in a massively greater ratio than we do in the United States. They are not concerned with short-term profits because they are going after market share.

They are going up that learning curve as fast as they can move. The results for our competitiveness are devastating. Japan is particularly effective precisely in the high-technology areas where the learning curve is the most important aspect of competition.

To point up the dimensions of this problem: You are focusing, of course, on solar and conservation industries. However, it reaches more broadly. In the 1980's and 1990's, the industries which dominate will all focus around one single industry. Computers, semiconductors and high-technology electronics, process control, information and data processing, and automated office management will all be structured around the spinal cord of telecommunications.

Now, in some of these fields we maintain the technological lead. But telecommunications is the area where governments control the terms of competition most effectively based on national security and national interest arguments. As you know, the telecommunications industries are most often nationalized in most of our major competitor countries. The result is that they have a framework upon which to control the markets for this whole nexus of leading technology industries. If we ignore that factor, we ignore these risks and the Japanese learning curve strategy, we face being limited to one market, our own, where the foreign competition is going to be very effective.

Now, some have argued, and in particular OMB over the years has argued, that there is no justification for a special export effort by the United States, that we are, after all, the leading industrial nation, the leading technological nation. I believe this is an incredibly naive and shortsighted attitude.

I am not in favor of large government intervention in trade. In fact, in my view, the less, the better. But to ignore what the competition is doing to support precisely their high-technology industries in the ways that Mr. Stingel and many others have pointed out, I think is incredibly shortsighted and self-destructive.

In concluding a general statement on the policy environment, I find it ironic that our foreign trade policy has been turned upside down, and has been inverted over the past 10 years. We have led, and put untold resources into negotiating, market access efforts around the world.

We have led this effort from a posture in which we have been the most competitively disadvantaged of all of the industrial export nations. We are disadvantagd by the many disincentives that have been put into legislation. We are disadvantaged by a policy structure which has prevented export trading companies. We are disadvantaged by numerous other structural aspects of our economy which are spelled out in the paper that I have submitted.

Instead of focusing on trade access and trade negotiations, we should have been focusing on bringing our competitiveness up to speed. Instead we have done much to open markets around the world which our competition was then far more effectively able to exploit than we.

This U.S. approach to foreign trade policy has simply aggravated our competitive disadvantage.

To look forward, the U.S. Government has a number of programs which I believe are not adequately designed to meet the needs current international trade competition. There are a number of programs where in a time of tough budget years we can make important improvements with little or no cost to the U.S. taxpayer. And I would like to suggest this is important.

In the first place, the National Association of Manufacturers have has forward the importance of establishing exporting as a national priority. Recent administrations have given lipservice to such a priority, but none has ever really taken it seriously as a national priority. I believe it is a vital national priority.

Second, at the policy level, the export trading company legislation which Congressman Bonker spoke on this morning is, in my view, the single most important action we can take at this time to assist the medium, small, and high technology companies which have the greatest difficulty getting established in foreign markets. This single act with little budgetary cost, to it can have a vital effect on our ability to build competitiveness in the high technology industries.

Third, at the policy level, I would just simply reinforce the importance of revitalizing the Eximbank as an equivalent competitor in the export financing area.

More specifically related to the technology industries, a number of programs can be improved at very little cost and with considerable effect.

One element of organization that has been very effective in the agriculture export sector is the use of a sectorial approach to export promotion. The Agriculture Department has a highly effective trade promotion program organized along sectorial lines.

The Commerce Department trade promotion programs, while focusing on medium and small companies, generally buckshot those companies, assisting them on an across-the-board basis. It is my belief that the Commerce Department program should be much more intensively organized along industry sector lines so that the private sector and the Government can work much more closely and effectively together. A number of programs presently in existence are quite adequate for export promotion, but could be made much more effective if utilized along sector lines.

The second aspect that needs considerable attention in managerial terms: high technology industries face the export markets in the most critical way at the entry point. They are not there yet and, therefore, entry into the market and a crack at that market is the most critically important stage of the game.

Your opening statement, Mr. Chairman, made a point that the difficulty of exporting high technology products may, indeed, be conducive to the licensing of that technology to foreign producers as an alternative, and, therefore, result in accelerating the transfer of our technological lead.

I am a firm believer that this is the case. I have seen time after time when American companies, with a nice domestic market to work in, looked at foreign markets and decided that they were too tough. The easy way to short-term profit through licensing does not recognize what impact that will have on our industries in 5 to 10 years time when the return flood of products spawned by these technology licenses begins to hit our shores. We need to encourage export market entry to reduce the resort to technology licensing.

There is one other program which Congress itself played a leading role in redirecting 5 years ago. This is the Trade and Development Program [TPP]. This program is languishing and is not yet an adequately effective program. It is a program designed to provide grant feasibility studies for export marketing. It is precisely in that area where our competition, the major industrial countries, have each used between $70 and $100 million to preempt entire markets abroad through the use of small amounts for grant feasibility studies.

In my own work in Indonesia, there was a pulp and paper project with an export value of about $1 billion in total value which the Canadian Government, with a small grant feasibility study, captured from U.S. suppliers and locked up for Canadian suppliers, this entire development potential. The Trade and Development Program has for some years been located under the AID program and its umbrella organization. I have forgotten the name of the structure.

Mr. GORE. IDCA.

Mr. HEGINBOTHAM. Yes. That organization has limited the program by leaving it subject to the legal and procurement restraints of the AID program which are in no way suited to the aims of that program. It is my belief that this program should be brought out from under the AID and IDCA umbrella and should be made responsible to a more senior official directly concerned with trade, but kept independent.

I would recommend that this committee and the solar energy industry consider working with the Trade and Development Program to establish an especially focused program, a grant feasibility study strategy to assist the entry and the export of this technology.

For example, in Pakistan at the present time the government is very much concerned with its growing energy import bill. It is looking at how to solve its energy problem. A small grant feasibility study looking at the potentials of solar energy for that country could provide a leading entry for that technology into the market.

I suggest that the industry identify a series of country priorities where they believe the technology might be most effectively used and then consider some very small grant feasibilities offered to the governments concerned to attempt to demonstrate the effectiveness of this technology.

At the same time such feasibility studies provide, in effect, market research for the industry and equips them to go into the market once the feasibility is established.

Finally, I would recommend that the Export-Import Bank, as limited as it's resources are, have established, because of the critical importance of high technology, a small fund specifically designed to aid the small exporter. Such a fund should be structured along sectorial lines so that the Bank is not having to deal with a whole series of small companies. Under an association or some other organized industry group, a sort of umbrella fund could be established on which the industry could draw credits subject to feasibility studies established by the Trade and Development Program, for example. Under the former Chairman of Eximbank, John Moore, the Eximbank was prepared to issue letters of commitment for export sales based on the findings of the feasilbity studies of the Trade and Development Program without going through its usual procedures of assessment. In this way the linking of those two programs can be a highly effective device, first for hitting the front end of the market before the competition is there and second, linking it directly as Chairman Moore did, for following up with financing to assist establishment in export markets.

I neglected one critical program that I feel is immensely important. It ties into the sectorial emphasis. I mentioned the Agriculture Department has been uniquely effective in promoting exports on a sectorial basis: They have a program which combines the resources of the private sector and the resources of the Government sector in a uniquely effective way. This is the Cooperator Program. It is, as agricultural officials will tell you, a primary explanation for the effectivess of the Department of Agriculture in promoting agricultural exports. It brings together associations or groups representing a particular industry sector who then work with the appropriate Government agency. They establish a joint program for export promotion. They provide joint funding—matched funding—to carry out the program. In some cases the associations actually employ representiatives who serve abroad in helping the Government officials to develop that market.

In a situation where our U.S. Foreign Commercial Service is outmanned 40 to 1 by most of our industrial competition in terms of effective manpower to do the job, the ability to draw the private sector into a collaborative relationship along sectorial lines in export promotion can, as it has in the case of the Agriculture Deparment, actually double the manpower abroad available to their export promotion and has done so at very little cost to the U.S. budget. So I commend to the committee that technique which, incidentally, the U.S. Chamber of Commerce is in the process of studying and has found very favorable. I expect that within the next couple of months, the Chamber will issue its feasibility study recommending this technique. But there is no need for the committee or the industry to wait for this report before pursuing that possibility.

Mr. Chairman, I very much appreciate this opportunity and I commend the committee and hope that it will persist in working on this topic with the various agencies of Government.

[The prepared statement of Erland Heginbotham follows:]

TESTIMONY FOR HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY

EFFECTIVENESS OF CURRENT PROMOTION PROGRAMS FOR EXPORT OF U.S. TECHNOLOGIES

RECOMMENDATIONS FOR IMPROVEMENTS

Remarks of

Erland H. Heginbotham

Director for Asia
International Reporting Information Systems

June 17, 1982

TESTIMONY FOR HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY

EFFECTIVENESS OF CURRENT PROMOTION PROGRAMS

FOR EXPORT OF U.S. TECHNOLOGIES

RECOMMENDATIONS FOR IMPROVEMENTS

The Setting

In addition to the export disincentives created by legislation which Mr. Stingel has explained, U.S. exporters face a wide range of other disadvantages. These include:

Government policies and practices which complicate exporting, and
Structral disadvantages built into the U.S. economy

Government policies, to name just three, have made the United States
--the only industrial nation which has effectively prevented development of major national trading companies;
--the only country but Switzerland which taxes its citizens on their earnings abroad;
--the one industrial nation which provides government-supported export financing for a smaller fraction of manufactured exports than any of its competition except Germany.

Structural Disadvantages include:
--the huge size of the U.S. market which discourages marketing abroad
--the maturity (slow growth) and openness of the US market which reduces chances to improve competitiveness;
--our isolation from other markets and international competitive conditions which shields our awareness of competitive developments;
--our unique dependence on equity financing which causes a preoccupation with short-term results and disadvantates export market development.

The Programs

Most USG programs reinforce the disadvantages of U.S. exporters because in general they are less comprehensive, considerably less well financed and less effective than those of governments in competitor countries. The disadvantage to medium and small exporters is particularly great because the limited USG financial support tends to go to larger firms. The Foreign Commercial Service with its extremely limited resources is an excellent example of the severity of the limitations of USG programs. FCS staff and budget are less than one twentieth those of competing government commercial services when compared with the size of the industrial sector they serve. Yet they are intended to support U.S. exports which face increasing disadvantages in competing in world markets for industrial products.

Commerce Department programs are the one area of government export services which are more oriented toward medium and small firms than those of competitor governments. However, these programs do not make up for other more serious disadvantages such small U.S. firms face:

--absence of major trading companies to assist them;
--shortage of govt-assisted financing for small firms; and
--limited extent of industry-sector-based promotional programs.

The Need:

Given the many disadvantages U.S. exporters face, we need program improvements which will do much more to:

mobilize greater private sector efforts in exporting
make much more effective use of USG programs which can help the medium and small firms particularly; and
do far more to develop the synergism and multiplier effects of joint business-government export promotion efforts.

Proposed Improvements:

I am pursuaded that we can make great improvements at virtually no cost to the U.S. taxpayer. In fact the improvements I propose would probably increase significantly U.S. exports and revenues with very little cost to the taxpayer.

These improvements are:

First, and most important: passage of the export trading company legislation; the central objective of this bill should not require any financial aid to achieve;

Second, reestablish the Trade and Development Program, to create an effective means of getting U.S. firms in on export opportunities at the very earliest stage in market development;

Third, create a counterpart for the industrial sector of the highly successful Cooperator partnership with the U.S. agricultural sector has carried on so effectively for over twenty years;

Fourth, revise Eximbank's charter to assure that medium and small high technology firms have access to export financing at least equivalent to that available to exporters in our major industrial competitors.

The Particulars:

Export Trading Companies:

Passage of export trading company legislation would fill a great void in the U.S. export armory. The absence of large U.S. trading companies leaves us without the kinds of door-to-door services which assist primarily the medium and smaller companies which dominate in many high technology industries. It is no coincidence that U.S. trading companies, limited as they are, handle less than 10% of U.S. exports of manufactures. For our industrial competitors in Europe and for Japan and Korea, such firms handle 30-45 percent of manufactured exports.

Feasibility Study Financing:

This is a technique our competition has developed into a highly effective technique of international market penetration. All of the competitor European nations I studied year before last — some six as I recall -- had funds of between $50-100 million which they used to offer grant feasibility studies to foreign governments and private sector firms. Usually these grants require use of donor country firms. For a small fraction of on-going project costs, these feasibility grants are often effective at giving firms from the donor country the onward project business. Usually these funds gain the donor country export business many times the value of the grant.

The U.S. Government has a very small program of feasibility study grants, thanks to intervention by the Congress some five years ago. The program has not had vigorous independent leadership, but it has potential, and it has more funding now than ever before. I consider this program the ideal instrument for launching an effort of export promotion for high technology companies. Its advantages for this purpose are that it:

-- gives new exporters an opportunity to get in at the beginning of market development, before competitors are established;
-- orginates from a small agency, permitting sustained effort and Congressional interest to have more direct impact in formulating programs and identifying opportunities;
-- permits U.S. industry to spot situations where high technology applications appear promising, but feasibility studies may be necessary to verify the economics;

This program has special appeal for solar energy, for example. The oil crisis and price escalation has encouraged countries to consider alternative energy applications. The industry can contribute to economic development abroad by identifying countries where solar energy has particular promise. A proposal for a grant feasibility study of this potential would probably be welcomed by a number of struggling developing countries and would give U.S. companies the edge at developing this potential.

Cooperator Program

As a country that comes in near the end of the pack in the application of national and government resources for export promotion — a race we can no longer afford to lose — the U.S. must look particularly for ways we can multiply the resources we devote to exporting. Wherever possible, we must look not just for more U.S. federal or state government effort, but for ways in which we can combine forces, government and private.

U.S. agriculture discovered this proposition some 20 years ago. Foreign Agriculture Service officials will tell you that one of the two main secrets of the highly successful and productive relationship between government and the farmer in the export field is their Cooperator program.

Under this program, some 55 associations representing different U.S. farm products, carry out a wide range of joint efforts in export market development. Each association works out a contractual agreement with the Foreign Agricultural Service (FAS) under which the two parties agree to share responsibilities for the funding and implementation of the specific market development efforts they have agreed upon for the coming year. These joint efforts cover a wide variety of promotional activities, including:

market research
export opportunity identification
product adaptation and modification
export promotion efforts (e.g. advertizing, exhibits, etc.)

In some 24 of these agreements the associations also agree to send professionals employed by the associations to work overseas directly with the Foreign Agricultural Service personnel in implementing these efforts.

The practical consequence of this Cooperator program is that the matching contribution of the private sector roughly doubles both the funding and staffing devoted to U.S. agricultural export promotion abroad. Compared with the total U.S. government resources devoted to assisting export of manufactured exports, the FAS can devote nearly twice as much in funding and staffing for agricultural export promotion per dollar of U.S. agricultural exports, as the U.S. government devotes to manufactured exports. The comparison becomes even more unfavorable to manufactures when you include government financing, where PL 480 and CCC financing cover a much higher percentage of agricultural exports than Eximbank covers manufactured exports.

The Congress provided the seed money which fostered and supports the FAS Cooperator Program. No similar program yet exists for the manufactured sector, but the time is right and the need is great. This program has begun to attract more interest in the U.S. private sector. The National Foundation of the U.S. Chamber of Commerce has sponsored a prefeasibility study, lead by former Department of Commerce Assistant Secretary Frank Weil, which is nearing completion of its first stage. The draft study gives leading emphasis to the potentials of such a cooperator program for industry.

High technology industries need not wait for action by others to launch such a program. I would recommend that interested members of the Committee and the industry meet with the leadership of the Foreign Commercial Service to explore the possibilities for a pilot effort in this direction. At the outset it might involve something very simple, such as a very modest contribution of funds from the industry to permit the FCS to carry out some market research to identify countries where, for example, solar energy would have particularly promising applications. Such research might in turn become the basis for working out with the Trade and Development Program some proposals for grant feasibility studies. If this first cooperative venture proves beneficial, the scope of the Cooperator endeavor could be broadened, and the Congress might be pursuaded to recongize and assist the effort.

Because of my strong conviction about the desirability and feasibility of such an effort, I would be happy to assist should the industry wish to explore this concept. My experience as former Director General of the Foreign Commercial Service might be of some value in working out such a program.

Eximbank Financing for High Technology Exports

Eximbank, as we have seen, is not oriented to small scale export financing. However, in recent years, Eximbank was willing to grant preliminary commitments for exports in association with projects and exports for which the Trade and Development Program had funded feasibility studies demonstrating the economic practicality of the project or export.

If high technology industries could persuade the Trade and Development Program to undertake a general program of feasibility studies in the high technology area, perhaps they could also persuade Eximbank to provide a general fund compatible with Eximbank's minimum lending level, to cover high technology exports for projects proven feasible under the TDP effort in that field.

To sum up, Mr. Chairman, while U.S. Government policies and programs have serious limitations, they also have some underdeveloped potentials. It would not require any legislation or addiitonal funding to capitalize on some of these U.S. government support potentials. It would require some determination and persistent effort by high technology industries to work out these potentials with the Trade and Development Program, Commerce Department and the Eximbank. I am persuaded that the obstacles are not that great but that the payoff in enhanced potential for high technology exports is considerable.

I would only stress again that even more important that what additional assistance the government might be is the extent of private sector energy and resources which could be liberated by passage of the Export Trading Company Legislation. I urge this as a first priority by anyone devoted to improving U.S. export efforts.

Mr. **Gore**. That is fine. Fascinating testimony.

Mr. Walgren?

Mr. **Walgren**. Thank you, Mr. Chairman. I really second the thought that both these presentations were real contributions to our thinking about our problems in this area.

Although I am not a member of this subcommittee, I wanted particularly to come to hear the testimony of Mr. Stingel. I enjoyed yours, too, Mr. Heginbotham, very much.

Mr. Stingel originated, or at least had an industry based in Pittsburgh before he went on to work with Export-Import Bank, so I feel sort of a special tie there.

Mr. Stingel, the one sort of politial Achilles' heel of the Export-Import Bank is the dominance of large companies in receiving the help that the Bank is able to give. What do you think of trying to create a special section of some kind that might broaden the Bank's ability to get involved with smaller companies? You stated that the smaller companies are left to commercial rates, but that they need export assistance. How can we change that? What steps do you think we should take to get involved with smaller companies through the Export-Import Bank mechanism?

Mr. **Stingel**. I think Mr. Heginbotham has hit the nail on the head. I think in the first place the OMB in both the Carter and Reagan adminstrations have been too tough on the bank in regard to funding and, therefore, the bank always has limited funds.

I know when I was there we finally got up to $5.1 billion of direct loan funding in the year, I believe, 1980 or 1981. That was the highest the Bank had ever reached. Today we are down to $3.9 billion and they are talking about lower funds in the next fiscal year. The demands for those funds are committed pretty much in advance each year.

Preliminary requests are received for many, many millions of dollars more than the loans it issues, so you go into it each year with your funds committed for large export sales that you are trying to make at that current time.

There should be some sort of a sector approach in the thing where perhaps you can't set up every type of industry, but you could take an industry that makes textile equipment and allocate it a certain amount of money, and farm equipment a certain amount of money, and construction equipment a certain amount of money and so on, because all of these things which are still of good export trade potential for example the Caterpillar and John Deere and Allis-Chalmers and all—they don't get financing for individual pieces of equipment for anything other than commercial rates. It is the U.S. exporter that sells the big plant or big project that gets the best interest rates of the Export-Import Bank and the other guy is sort of left out in the cold. So you almost have to say at the beginning of each fiscal year they are short of funds and, whatever funds there are are mostly going to the larger companies which sell the big ticket items.

The Bank needs more funding and it needs an approach to trade and the administration has to understand that right now industry and Government in this country are in an adversary position concerning export trade, whereas in every other country of the world that we compete with, they work arm in arm.

Their economic ministers go in on a big transaction right with the industry people to go sell the President of Mexico, for example, or other top government officials in a buying country. We are not allowed to do that because under the antitrust laws, we can't support one company over another and you can't take a whole bunch of different U.S. companies in to see, for example, the President of Mexico, to try to point out that you can do a better job in the electrification of say the Mexican railroad system.

So we lose out on many of these potential export opportunities because of the adversary position, and the fact that we don't fund the Export-Import Bank properly. We think of this as a subsidy without thinking of all the other benefits that additional export sales can create in jobs, taxes, and so forth.

I think you hit the nail on the head. That is the big problem. We don't finance medium and small exports to the degree we should.

Mr. **Walgren**. Is there any discussion within the Board of the Export-Import Bank of trying to broaden its range of participation?

Mr. **Stingel**. We could never reach an agreement on a particular approach. Two of the directors—I was one of them—tried to set-aside $500 million one year limited to projects $5 million and under. Normally projects of $5 million and over—it is not a written law or anything—are the ones that get the good financing. The projects $5 million and under do not.

Mr. **Heginbotham**. I might just add if I may, Mr. Chairman, that it is intriguing that the employment generated by medium and small companies is vastly more important to this economy than the employment generated by large major corporations. So, in a period when we are seeking to resolve a tremendous unemployment problem, I think it would be uniquely beneficial for the Bank to focus on assisting the growth of medium and small industries. That is where we are going to generate the employment.

I think that this recommendation should have the utmost priority in the Bank and on the Hill.

Mr. **Stingel**. One more thing, Mr. Walgren. I think the Bank wouldn't be criticized as much for funding Boeing, McDonell Douglas, Lockheed, and the others of the Big 7 if they helped more of the smaller and medium size companies and gave equal types of financing. But you don't want to miss out on the large exports and the large projects either because they create a lot of jobs. You want to be sure that you get more funding so that everybody can be treated equally.

Mr. WALGREN. Thank you very much. I appreciate your courtesy, Mr. Chairman.

Very interesting testimony.

Mr. GORE. Well, thank you. And it seems that sometimes the only way to make sure that small businesses get a fair shake is to have set-asides. We will be debating some thing similar on the floor today and I look forward to my colleagues' support, perhaps, on that.

Mr. STINGEL. Mr. Chairman, I might add one note of humor.

Mr. Heginbotham and I worked quite well together when we worked for the Government. It is nice now not to be inhibited in our testimony by the White House or anyone else. We can say in our own opinion now what is really wrong with the country's export policy.

Mr. GORE. That is refreshing and I may refer to your testimony later today.

Mr. Dunn?

Mr. DUNN. As long as your testimony is unrestricted here, how much does politics play in that decision to subsidize the Big 7 in the majority of Export-Import Bank projects? Remember you are unrestricted.

Mr. STINGEL. Politics plays a big part. I think everyone knows that. A particular Congressman or Senator is pushing for a project in his district that will help employment. I can think of all kinds of pressures that we had when I was a director of the Export-Import Bank. We tried to ignore that pressure, but it is awfully hard.

I tried to be as aloof as I could from that sort of thing. I tried to do what I thought was right for the country. I had no ax to grind, really. I came in as a Government employee for a limited period of time and did not intend to make it a career. My whole aim was to try to finance and get more U.S. exports.

As I say, I participated in $50 billion worth of projects in 3½ years in one form or another, but I think we could have done 50 percent more than that if we had had the funding to do it.

Mr. DUNN. I have some reservations about the Export-Import Bank simply because I believe our whole trade policy is in error. We are trying to walk a very fine line, if you will, and as long as we are not willing to stand up to the Japanese, in the case of exporting unemployment in the automobile industry or restricting beef into their country, as long as we are willing to look the other way while European companies subsidize their steel, I am not sure that simply going after low financing for Big 7 companies is a good way to do it.

Either we should truly go to a free market policy, that would include prohibiting governments from financing their industries, or we should take the opposite approach and go after them using our economic might and throw up the same restrictions on the Japanese or German steel or whatever. Trying to walk this middle line and using the Export-Import Bank, I am not sure is a feasible way to accomplish the long-range goals.

Mr. **Stingel**. I agree with you. The Export-Import Bank is only one tool and I said there were a lot of problems and I only tried to name four of them.

I think we pussyfoot around the whole Japanese trade issue. There is no question in my mind we ought to treat them exactly the same way they treat us. They are pulling all kinds of rinky-dink things on the United States.

If we ship a car to Japan, it gets a penalty inspection.

Mr. **Dunn**. I have a bill that does exactly that, H.R. 5050.

Mr. **Stingel**. The French have a limited number of inspectors on their dock. When a Japanese car comes in, it gets the same inspections that a French car gets in Japan and that slows them down tremendously. We just allow them to roll off the boat. They even show it on television.

Mr. **Dunn**. One last question. How does the administration justify subsidizing Big 7 companies by $3 billion per year and yet it is about to oppose the same thing, an interest subsidy bill, for the construction industry? Again, either you are for both or against both. It does not make a lot of sense to me.

Mr. **Stingel**. I was asked the same question in a hearing by Mr. Proxmire a couple of years ago and we looked up a lot of facts. The 14 largest capital goods manufacturers in the United States do more than 50 percent of the exporting from this country, so automatically they would be in the Bank with requests for loans to support their exports. Your top 100 manufacturers do about 80 percent of U.S. capital goods exports, so they automatically fall into that category. It happens to come out that way. The aerospace industry is the biggest U.S. exporter of capital goods still today and, therefore, Boeing, McDonnell Douglas and Lockheed, all fall in the top category.

Again, if there were more money available or if it were allocated to different sectors, then small and medium business would also get a share. It is a tough problem, there is no question about it. We wrestled with it every day as directors of the bank and never did solve the problem.

Mr. **Dunn**. Both of you, I take it, would be supportive of an amendment to Mr. Bonker's bill that a set-aside be included in the Export-Import Bank to target the kind of companies that he is after?

Mr. **Stingel**. I have said that before. I have suggested a $500 million as an initial amount and I tried to do that in my last year, but did not get the full support of the five directors.

Mr. **Dunn**. I thank you.

Thank you, Mr. Chairman.

Mr. **Gore**. Thank you very much.

Mr. Heginbotham, I am interested in your description of the Japanese learning curve strategy. We don't have much time left, so I wish you would briefly elaborate on what you mean by the learning curve strategy.

Mr. **Heginbotham**. In the high technology areas, particularly, Mr. Chairman, statistical studies have shown that with each doubling of plant capacity, it is normally possible to reduce costs by 20 to 30 percent.

When you create a whole new plant, you also introduce other improvements in the product, and cost savings of various sorts. The Japanese have used the approach, that given the American lead, they focus on the fast-growing markets where they can double their productive capacity more frequently than an American company focusing on the U.S. market with lots of competition.

If you look at, for example, the minimicro computer area, U.S. producers are increasingly struggling in that market against a lot more competitors. The Japanese, with a relatively limited number of competitors, go after those markets abroad where we have not focused. The result is they have generally achieved a much more rapid doubling of production experience and therefore, cut costs more rapidly, introduced more innovations and built up a lead in technology and product quality, costs, and other factors.

Mr. GORE. It is sort of like the New York Yankees building a farm club system to give the players a lot of experience starting and playing actively before they are brought into the big leagues.

In other words, the Japanese concentrate on the other markets in the world, outside of the major industrial customers, first, in order to gain the experience which comes from the initial scaling up of production capacity. By the time they reach the industrial customer and are ready to compete, for example, in the American market, they have already integrated into the production and design process all of the experiences that they have gained from their playing time, to go back to that perhaps awkward metaphor, in the smaller countries where they have doubled their production capacity several times. Is that sort of what you mean?

Mr. HEGINBOTHAM. That is correct and the metaphor is particularly apt because the big league teams don't expect to make a lot of money with their farm clubs.

Mr. GORE. Yes. And the other part of it has to be a great deal of attention to learning the lessons which come early in the production process, harvesting the ideas that people involved in the process have learned from experience and integrating those lessons into the first scaleup. The American companies don't do that very well either, wouldn't you agree?

Mr. HEGINBOTHAM. I can't speak from too much direct experience with American companies and their processes, but certainly not enough to keep up with the competition.

Mr. GORE. Well, I have a number of other questions and I think what you have to say is important, so rather than going straight onto the next panel, if you will be patient again, in about 6 minutes we will come back. We have another vote on the floor.

[Brief recess.]

Mr. GORE. The subcommittee will come back to order.

I want to apologize to our witnesses for the disruptions, but we have a busier day on the floor than we thought we were going to have.

We were talking about the learning curve, Mr. Heginbotham, and I want to read into the record a statement that is included in your longer piece: "U.S. firms and policymakers who think we have to improve our ability to compete with Japan in the U.S. market have lost the battle before it begins. By the time Japan's high technology products reach U.S. shores, they have, in most cases, already achieved insuperable competitive advantages in price, quality and often in service."

That sort of illustrates the learning curve strategy that you mentioned earlier.

You know, I have wrestled with these export policy issues for some time, and a lot of the focus has been on what government policy should be or should not, the export trading company idea, the support for exports, obstacles of one sort or another that the laws impose. But, would you agree with me that the government role is only a part, and perhaps less than 50 percent of the problem. Most of the problem, wouldn't you agree, derives from our historical preference for concentrating on the vast domestic market and the slowness of American companies to adjust to the new realities of the world market to adopt new, proven management techniques and marketing strategies that would enable them to compete more successfully in the world economy economics? Would you agree with that Mr. Heginbotham?

Mr. Heginbotham. I think there is a cart and horse problem here to some degree, Mr. Chairman. It is my belief, having observed abroad first-hand for some 25 years, that much of the gap in U.S. competitiveness has been generated by perverse Government policies.

For example, the export trading company legislation is not really a question of what Government can do, but rather of getting Government out of the way of the private sector. In other words, we are, as Congressman Bonker said, the only country in the world, that has prevented the development of export trading companies by preventing banks from getting into that business.

Mr. Gore. Well, let's take that example. There are a lot of foreign companies that compete much more successfuly overseas whether they have an export trading company or not, aren't there?

Mr. Heginbotham. There are, but if you note, a colossal percentage of American exports are handled by the top 200 firms, while for the vast majority of our competitors, medium and small companies play a very large role in exporting. And the reason they are able to do that is that trading companies provide the interface between the domestic market and the infinite number of unknowns in exporting abroad. Thus the absence of trading companies has, in my view, accounted for the tremendous difficulty that medium and small companies have in getting into that market.

Now, let me give you a further example of perverse policies. At the very time, following the oil crisis, that we needed to enhance our competitiveness, unfortunately, the tax laws were changed and that forced the repatriation to the United States of the most experienced business people. This, in effect, forced a retrenchment of American business involvement overseas. It cut us off from direct knowledge and experience with the activities of foreign competition, in the process, isolating us and leaving us more complacent about our own effectiveness.

So these and other Government policies have played a major role at critical times in isolating us. If you think back, Mr. Chairman, to the 1950's when the dollar was strong, when American companies were going abroad, acquiring and investing heavily in the European market, there was no lack of American incentive to find and move into markets and to compete in them when conditions were right. But it is my belief that since the 1950's, we have interposed so many obstacles and so many difficulties that we have, in effect, increasingly isolated ourselves from knowledge of the competition and, therefore, we have lost the spur to maintain our competitiveness.

Mr. GORE. Thank you.

Mr. Stingel, do you think that the Eximbank should be a self-sustaining entity?

Mr. STINGEL. I think it would be a difficult thing to be totally self-sustaining, particularly when interest rates are high. It was self-sustaining for a good many years and actually created a profit of about $3 billion. But for the last couple of years, it has been borrowing from the Treasury at rates up to 15¼ percent and lending at rates that range from 8¾ to perhaps 12 percent. That quickly eats into the reserve that they have built up.

I think that any Bank has to go through this sort of thing and I think the Bank should be treated more as a private institution is treated, dipping into reserves occasionally.

Personally, I think Eximbank ought to be out of the Federal budget, but that is a difficult thing to do today because there has been so much focus on it. I think the Bank should be treated as a bank. I think it needs a subsidy at times and other times it should depend on its reserve.

On your earlier point about why American businessmen have difficulty doing business overseas today, I agree with you that they just say in many cases, particularly small business yes, what is the use, it is too much trouble, we still have a domestic market. But if some of these other things were straightened out and the Export Trading Company bill were passed, maybe they could band together and learn to sell again like they once did.

Mr. GORE. To what extent are the exchange rates really hurting U.S. exports at this time?

Mr. STINGEL. Well, if you listen to the economists, and I never saw an economist yet that really sold anything overseas.

Mr. GORE. It is open season for economists this year. Go right ahead.

Mr. STINGEL. Anyhow, the strong dollar does make it more difficult to compete, there is no question about that, but I don't think that it is really the thing that is hurting our exports. I think that if we did the proper amount of financing and removed some of these disincentives, as Mr. Heginbotham has said, we could compete better in the foreign marketplace. We still have good technology in this country, but we are not going to have it for long if we don't sell.

Mr. GORE. Do you see a trend leading toward the United States becoming an importer of technology rather than an exporter?

Mr. STINGEL. I see it in a number of industries, particularly some of the older industries like steel where we now have Japanese showing us how to run our own steel mills. I think that that trend will grow to a degree because the Japanese have become pretty expert in certain fields that we have sort of let go by the board. We haven't spent the R&D money on them because we are not making money in some of those industries.

Mr. GORE. So, you think that in those areas where the Japanese are targeting a particular technology or product, it is likely that we will end up as an importer of that technology.

Mr. STINGEL. Buying that technology, yes.

Mr. GORE. Well, they have targeted solar energy, so based on patterns in the past it is fair to predict that unless we make a dramatic change from the current pattern, we will soon be importing Japanese solar technology.

Mr. STINGEL. Yes, I don't think the Japanese use a shotgun. I think they use more a rifle in their approach.

Mr. GORE. Yes. Maybe a semiautomatic weapon.

Mr. Heginbotham, the Japanese have recently made a major commitment to solar engery and particularly to the amorphous silicon photovoltaic cell. One of their strategies, in addition to funding R&D is to manufacture these cells and market them on a variety of products, calculators, watches, and toys. There are other reasons for doing this, but it fits into an overall strategy for amorphous silicon cells. Although each unit is small, the total manufacturing volume is quite large. Does this seem familiar to you in terms of the learning curve strategy? Are we seeing a learning curve strategy relating to amorphous silicon photovoltaic cells?

Mr. HEGINBOTHAM. It is definitely related. This is a technique which has been used in the semiconductor area and it points up another problem we face in competing with Japan.

In this field we lead in the development of the technology. They imported our chips in the early stages, and, then we suddenly found that once they had developed or come up to speed on the technology, it suddenly became very difficult to sell in the market. Of course, we were trying to sell especially into the market of products which embodied those chips in consumer items, exactly the example you have been giving, and that was precisely where we lost out.

There was an extremely revealing article that appeared in the press about 2 weeks ago. It illustrated the experience of the Sony Corp. which has taken up the gauntlet and has tried to export American products to Japan to prove that we could do it if we tried. They ran into this same problem—as soon as they had developed a market for American products, it went like gangbusters for the first 2 or 3 years and then suddenly all the doors started closing and the market just dropped to nothing, once Japanese firms introduced competing products.

So one of the lessons in this is that it is very tough to continue competing with the Japanese market, but another lesson that the semiconductor industry is discovering, is that it is critical to invest in the Japanese market, to produce there in competition with the Japanese. It is not an unbeatable technique the Japanese have, but investing there directly is the best answer yet available to beating the obstacles.

Mr. GORE. I am interested in the concept of a cooperative agreement or partnership. Would that approach be feasible for the renewable energy and energy conservation industries?

Mr. HEGINBOTHAM. I believe, absolutely, it would, Mr. Chairman. When I was Director General of the Foreign Commercial Service we approached a number of industries about the possibility of working with us on that basis. It can be done very simply.

In my view, all that is necessary is for representatives of the industry to sit down with the leadership of the Foreign Commercial Service and agree on what kind of common effort would be feasible. In the simplest form, this effort could take the form simply of the Association providing small amounts of money which the Foreign Service would then use to contract for feasibility or market research studies. It could then elaborate into a much more complete joint program. It is a technique, in fact, in which I am intensely interested and whose potential has been demonstrated in agriculture. I would be more than happy to assist in any way as that effort goes forward.

Mr. GORE. Did you want to comment, Mr. Stingel?

Mr. STINGEL. I would say that the passage of the Export Trading Company Act would really sew this thing up and make it very feasible.

Mr. GORE. I am interested in mixed credits as well. I understand the French have used this approach to market their solar equipment and I understand that we now have a trade finance facility that deals with mixed credits, but that the program is restricted to equipment. Is an entity like the TFF a good idea and could it be used to assist solar technologies?

Mr. HEGINBOTHAM. The concept and the technique is certainly one that is used widely and effectively. In a developmental context, it makes a lot of sense. The developing world has argued for years in favor of more transfer of technology. This is the ideal way for us to help transfer technolgy, but in product form.

The use of mixed credits, I think, has the potential to relate very directly to some high priority development needs in under privileged and hard-pressed developing countries. It is a very sensible technique in my view.

I would add from a philosophical perspective, I really think it is unfortunate that governments are using so much direct intervention in the marketplace.

In other words, I would much rather see us not have to have an Eximbank at all, but given the realities of the competitive world and the frequency of mixed credit use, I think it is one we should definitely consider.

Mr. GORE. Well, I don't know when I have heard two more fascinating witnesses on such an important topic. I am going to do my best to make certain that it comes to the attention of my colleagues on the floor when relevant legislation that comes up at various times is considered. You have made a tremendous contribution to the record of this hearing and to our understanding of the issues. We really appreciate it. Thank you very much.

Mr. HEGINBOTHAM. Thank you for asking us.

Mr. GORE. We have one other panel made up of two witnesses, but we have another vote on the floor. This will be the last vote before the conclusion of the hearings almost certainly, because we will have a period of general debate, but we will break for about 6 minutes and then we will have the final two witness.

Mr. GORE. The subcommittees will come back to order.

I would like to welcome to the witness table our final two witnesses, Mr. Bradford Mead, chairman of the Export Council for Renewable Energy here in Washington, and Mr. Charles F. Sills, vice president of Intersol Power Corp. also here in Washington.

Welcome to both of you gentlemen. Without objection, your prepared statements will go into the record in full.

We would like to begin with you, Mr. Mead. Welcome, and please proceed.

STATEMENTS OF BRADFORD MEAD, CHAIRMAN, EXPORT COUNCIL FOR RENEWABLE ENERGY, WASHINGTON, D.C., AND CHARLES F. SILLS, VICE PRESIDENT, INTERSOL POWER CORP., WASHINGTON, D.C.

Mr. **Mead**. Thank you, Mr. Chairman.

I am chairman of the newly formed Export Council for Renewable Energy. Appended to this testimony is the Export Council's mission statement and list of member organizations.

I also chair the International Trade Committee of the Solar Energy Industries Association. SEIA's membership includes over 325 companies involved in the research, demonstration, manufacture, distribution, and sale of solar energy products in the United States and overseas.

I find myself in the unenviable position of following three speakers who have very eloquently stated just about every major point I hoped to make on behalf of our industry. All that remains is perhaps to bring it down to a level of the exact industry and what our problems are and what we think some of the specific solutions might be.

The success of much of the American renewable energy industry depends on its ability to sell its products worldwide. For many companies growth in international sales must be made to improve revenues and to lower per unit costs. The success of U.S. companies in their international sales depends in turn partly on the willingness of the U.S. Government to extend a helping hand to overcome some of the handicaps we face in relation to our foreign competitors.

Specifically, these handicaps include concerted marketing support by foreign governments for their renewable energy companies; established market prominence by some of the exporting countries in their former colonies, and just generally a lack of experience of the United States in how to conduct and support export trade.

We have traditionally been a backward market type of industry. Most of the country has. According to the Department of Commerce we only export about 10 percent of our total product in this country as a total industry. The solar industry, however, has done much better than that. Specifically in photovoltaics, we are exporting over 50 percent of the total production. International exports are very important to our industry.

U.S. renewable energy companies, however, are not looking for bailouts through export programs. Rather, we are looking for minimal effort from the Government to help place some balance in what is a cutthroat and nonfree international market environment.

It is a market that may well be crucial to the survival of U.S. industry, and thus crucial to protecting the investment this country has already made through the past years through the dollars it has spent for research and development in renewable energy production.

An immediate step that we strongly support is a $2 million appropriation for fiscal 1983, to continue a program for renewable energy overseas trade show that occurred in 1981 most successfully. This modest expenditure out of the renewable energy budget can have extremely large short-term payoff. The 1981 program is estimated to have generated sales for U.S. companies in excess of 100 times greater than the Government outlay.

We also support the trading company legislation in order to make an important new tool available to exporters and at the same time we feel close competition needs to be made of existing Government tools such as the Eximbank, OPTC, AID, and the trade and development program.

I would like to focus attention on the commercialization support that our foreign competitors have received from their governments. Part of that support comes from the government R&D programs.

As you have been told in your previous day of hearings, foreign governments tend to place their primary research emphasis on near-term product development, both for their own oil displacement and for export sales.

The market support goes far beyond research and product development, however. Long-term investment and marketing strategies are sometimes made jointly between industry and Government. Frequent trade missions composed of Government officials and businessmen visit developing countries drumming up renewable energy business. Demonstration projects using off-the-shelf components are donated to developing countries, leading to future sales.

In short, the principal nations with whom we compete—France, Germany, and increasingly Canada—have made a conscious policy decision to pursue aggressively the export market for renewable energy.

I would like to just list some specific cases that we have witnessed around the world where foreign competition in partnership with their governments have gone ahead and implemented projects that have made it very difficult for American companies to compete.

In Greece, the Germans have donated five 11-kilowatt wind machines, manufactured by the German company, MAN, as a demonstration project. This same procedure was used by the Germans in Malta.

The Japanese company, Yazaki, has been very successful in promoting their flat plate solar collectors. They have been active in a number of countries, including the Philippines, Australia, Chile, and Spain.

In Egypt the Canadian Government backed the Canadian company Petro Sun in winning a contract for 2,000 solar water heaters. Ironically, the specifications for the project were written with technical assistance from the U.S. Government. The specifications, however, contain so many stringent provisions that no U.S. company without substantial Government backing could ever meet the requirements.

By citing these examples and describing the nature of the competition we are facing I don't mean to imply that U.S. companies are frozen out of the international market already, but frankly, it is getting a lot colder. Export markets are a very important component to the American solar industry. And although we are still the largest exporter of renewable products in the world market, in 1980 American renewable energy products totaled $36 million. These figures are only a tiny fraction of the sales potential beginning to take shape.

The instances I have cited indicate clear trends pointing to serious problems ahead. Increasing stiff government-backed competition is laying the groundwork for carving out large market niches that U.S. companies will not be able to penetrate.

Smaller U.S. companies especially will be left behind, unable to devote resources to the complexity of fighting the international competition.

The Export Council for Renewable Energy support acts in several areas to help meet the international competition. Specifically, we would like to see the continuation of the internatonal market development program. This particular program was run in 1981, and was most successful. It was one Government program that attempted to alleviate some of the competitive disadvantages facing our industry. During that year, for approximately an investment of half a million dollars, GAO reports that the American companies returned some $60 million in exports in 12-month future sales. That return on investment clearly indicates the cost effectiveness of such trade promotion events.

The concept of cost sharing in the sponsorship of joint industry Government trade shows had the most significant effect on the middle and smaller sized businesses who for the first time were able to participate in the internatonal market. And many times frankly their technology was very exciting overseas.

For the first time they had been there and did not know how to go after the export markets. They were encouraged by their potential customers overseas but didn't know how to begin. Again the export trading company legislation will do a lot for that situation.

A reinvigorated market development program under the aegis of the Department of Commerce would represent the single most immediate and cost-effective way to promote these products overseas. In addition, the leverage of each tax dollar spent on such an effort will benefit our balances of trade and the growth of our industry.

The export trading company legislation that was outlined earlier today is something that we are very strongly supportive of. If the U.S. renewable industry is to remain competitive with Japanese, French, and German manufacturers, the U.S. banking community must be allowed to play the financial and strategic planning role their foreign counterparts are accorded by their respective governments.

Finally, we think it is very important that all the various agencies and departments that are involved in various programs for helping American companies go overseas be coordinated.

First, a conscious policy decision by the Government must be made that the renewable energy is of particularly long-range importance, and to our domestic interests as well as to our overseas interest.

Second, a review of the structure and criteria of each one of these programs is very important. There are a number of agencies, the Export-Import Bank, Trade and Development Program AID, OPIC, and the Trade and Development—International Trade Administration, Department of Commerce, that are all running separate and quite distinct programs for different reasons and different philosophies. We think these could probably be coordinated to the benefit of American industry a lot better.

Third, we have to establish a focal point. However that coordination is to occur, there has to be some agency responsible for the focus and coordination.

I shuddered twice this last year, once in Nairobi, and once when I heard the administration's proposition in Cancun regarding the Third World energy problem and the American response to that was that the private sector was going to be the solution, the American private sector. We are very excited about being part of anybody's solution to the energy problem overseas. We also have to report to our shareholders, and this is somewhat of a different problem.

The fear in going into the Third World is multiplied by the fact that we don't understand these markets, we have never been in these markets, and we have no traditional ties to these markets. It will be impossible for American companies to go into these markets in force and to become part of that solution that the administration would like to have without having some sort of export assistance and some sort of marketing assistance.

Again the program that was written, the international market development program, under the aegis of Commerce, was such a program that might give us that type of introduction.

The free market in the international arena is really kind of a myth. We need our Government to be a partner to use in the same way that other governments are partners to their companies.

As it stands now, the real world of international marketing for renewable energy is one in which the United States will increasingly lose ground because it is not playing under the same rules as our competitors. We may not like those rules, but until they are changed, and that will not happen quickly, we must be prepared to put some of our own export support tools to better use on behalf of renewable energy. Failure to do so will preclude us from many long-term international markets, and as a result will also impede our ability to grow sufficiently to meet the future needs of the domestic market.

We have made quite a sizable investment in this industry in this country. It is my hope and the industry's hope that we can protect that investment and give the American taxpayer the return that he would like to see.

This concludes my testimony, Mr. Chairman. I want to thank you for holding these hearings. I think they are timely.

Thank you very much.

[The prepared statement of Mr. Mead follows:]

Statement of the
EXPORT COUNCIL FOR RENEWABLE ENERGY

before the

Subcommittee on Energy Development and Applications
and the
Subcommittee on Investigations and Oversight

of the

Committee on Science and Technology
U.S. House of Representatives

Presented by
Bradford Mead, Chairman
Export Council for Renewable Energy

June 17, 1982

Mr. Chairman, thank you for this opportunity to discuss international marketing activity for renewable energy.

I am Brad Mead, Chairman of the newly-formed Export Council for Renewable Energy. Appended to this testimony is the Export Council's mission statement and list of member organizations. I also chair the International Trade Committee of the Solar Energy Industries Association. SEIA's membership includes over 325 companies involved in the research, demonstration, manufacture, distribution and sale of solar energy products in the United.States and overseas.

In addition, I am Director of International Energy Programs for Grumman International, Inc., a wholly-owned subsidiary of Grumman Corporation. We are one of the largest domestic manufacturers of solar hot water systems, and we are actively engaged in efforts to sell our products overseas.①

On behalf of the national organizations who have formed the Export Council for Renewable Energy, I would like to express our strong appreciation for the attention your Subcommittees are placing on the need for international commercialization of U.S. renewable energy technologies. The Science and Technology Committee has long been in the forefront of supporting U.S. technological development for alternative energy sources. We are pleased with the concomitant concern for seeing to it that the technological developments are put to use.

Right now, and for the foreseeable future, the success of much of the American renewable energy industry depends upon its ability to sell in the world market. For many companies, increased production capacity that will lead to lower unit costs depends on growth in overseas sales. And the support of U.S. companies in their international sales depends, in turn, partly on the willingness of the U.S. Government to extend a helping hand to overcome some of the handicaps we face in relation to our foreign competitors. Those handicaps include:

- concerted marketing support by foreign governments for their renewable energy companies;
- established market prominence by some exporting countries in their former colonies;
- a general lack of experience in the U.S. on how to conduct and support export trade, compared to other countries which have long had to place a high reliance on export sales and have developed sophisticated infrastructures to facilitate their exports.

The U.S. renewable energy companies are not looking for bailouts through export programs. Rather, we are looking for minimal effort from the government to help place some balance in a cutthroat and non-free international market environment. It is a market that may well be crucial to the survival of the U.S. renewable energy industry, and thus crucial to protecting the investment this country has made in past years through the dollars it has spent for research and development in renewable energy production.

An immediate step we strongly support is a $2 million appropriation in fiscal year 1983 to continue a program for renewable energy overseas trade shows along the lines of the highly successful program conducted jointly in 1981 by the Department of Energy and the Department of Commerce. This modest expenditure out of the renewables budget can have extremely large, short-term payoff. The 1981 program is estimated to have generated sales for U.S. companies in excess of 100 times the government outlay.

We also support enactment of export trading company legislation in order to make an important new tool available to exporters. At the same time, we feel close examination needs to be made of existing government tools, such as the Export-Import Bank, OPIC, AID, and the Trade and Development Program, in order to determine how they might better provide support for renewable energy exports. In order to pull these tools together there needs to be a clear focal point in the government responsible for renewable energy exports.

Before discussing our recommendations, however, I would like to describe some of the problems we are encountering in our overseas marketing and which brings abou t the need for export suport programs.

Marketing Support Programs of Other Governments

On an earlier day of hearings you were presented with documentation of the plummeting scale of U.S. research and development spending for renewables relative to R&D programs of the countries with whom we compete. There is no need today to restate the quantitative aspects of the slashed budget for renewables in the U.S. Suffice to say that as our R&D efforts are going way down, the efforts of other countries are either going up or, at least, are being trimmed more gradually than our efforts. As described by Mr. James Corr in summarizing findings of the analysis of country spending conducted by DHR, Inc.,, "if the U.S. solar budget is reduced in 1983...[as proposed] it will undoubtedly become one of the lowest as a percentage of total energy spending in the developed economies, and will in fact fall below, even in absolute terms, the levels of several countries much smaller than the U.S.A."

I would, however, like to focus attention on the commercialization support that our foreign competitors receive from their governments. Part of that support comes from the government R&D programs. As you have been told in your previous day of hearings, foreign governments tend to place their primary research emphasis on near-term product development, both for their own oil displacement and for export sales.

The market support goes far beyond research and product development, however. Long term investment and marketing strategies are sometimes made jointly between industry and government; frequent trade missions composed of government officials and businessmen visit developng countries drumming up renewable energy business; demonstration projects using off-the-shelf equipment are donated to developing countries, leading to future sales for equipment from the same company; training programs run by companies but financed by the government are provided to developing countries, again leading to future sales of familiar systems; aid programs are tied to broad purchasing arrangements for equipment from the donor countries; and most importantly, liberal financing is made available through export financing subsidies and through mixed financing packages (export credits and concessional aid).

In short, the principal nations with whom we compete -- France, Germany, Japan, and increasingly, Canada -- have made a conscious policy decision to pursue aggressively the export market for renewable energy. They see renewables as an important growth market in the Third World, and as an important industry to have strongly established for their own domestic energy needs. By doing whatever is necessary to establish an early market presence in the Third World for their own companies, the governments of foreign competitors are attempting to assure that their companies will be in the right place as the growth in renewables takes off.

It should come as no surprise that we face this type of competition in the international renewables market. Other countries regularly employ industrial policies in which key sectors are strongly supported in domestic and international markets. Those industrial policies can have effects far beyond the country which initiates the policies. This is particularly true in hard economic times when it is attractive to export unemployment. Witness, for example, last weeks's finding of massive dumping by foreign steel producers in which exports to the United States were found to have been subsidized at rates up to 40%.

The support policies that other countries provide their renewable energy countries manifest directly as projects lost to U.S. firms. Anyone dealing in this international market knows that frequently the first question asked in a developing country is "What kind of external financing can you provide?" Having no competitive financing package to offer, the U.S. firms are often off to a very weak start. One major U.S. photovoltaic firm has noted that "we write the specifications for projects, and then other companies with country financing make the deals."

It may be useful to list some of the specific cases I have witnessed:

- In Greece, the Germans donated five 11KW wind machines, manufactured by the German company M.A.N., as a demonstration project. The same procedure -- free, large-scale wind machines donated as a demonstration project -- was used by the Germans in Malta.
- The Japanese company Yazaki has been very successful in promoting their flat plate solar collectors through unbeatable financing packages. They have been active in a number of countries, including the Philippines, Australia, Chile and Spain.
- In Egypt, the Canadian government backed the Canadian company Petro Sun in winning a contract for 2,000 solar water heaters. Ironically, the specifications for the project were written with technical assistance from the U.S. government. The specifications, however, contained so many stringent provisions (e.g., advance deposit of all project costs in an Egyptian bank) that no company

without substantial government backing (and thus no U.S. company) could have met the requirements.

Representatives from other U.S. companies have told similar stories. For example:

- o In Bahrain, an American company initiated the idea for a major photovoltaic project last year, but lost out when the French stepped in and donated a PV sytem for the entire U.S.-conceived project.
- o In China, a group of U.S. solar company officials were invited on a trade mission in 1979. The group traveled at their own expense only to find that the Chinese expected assistance programs, not commercial projects. Simultaneously a delegation of German company representatives arrived in China, announcing a $DM 3 million solar "starter" program consisting of a series of demonstration projects. The Germans were thus off to a good start in building Chinese market potential while the U.S. companies were left in the cold.
- o In Iraq, Jordan, and Kuwait the Germans have given money to research institutes with the intention that the German firm AEG Telefunken would get project contracts. The Japanese have used the same approach in Qatar and the U.A.E.

- In Dominica a French firm won a geothermal bid after the French government financed the project's feasibility study.

- Through governmental agreement, the huge IEA project in Almaria, Spain was carried out in part by American firms and in part by German firms. The juxtaposition of the two governments provided a study in contrast of approach. The U.S. government maintained its traditional arms-length posture in relation to the American contractors. At the same time, the German firm worked in close cooperation with its government and received support in getting as much of the business as it could.

By citing these examples and describing the nature of the competition we are facing, I do not mean to imply that U.S. companies are frozen out of the international market already. Far from it. Export markets are a very important component in the American solar industry's sales portfolio, and the U.S. is still the largest exporter of renewable products in the world market. In 1980 American renewable energy exports totaled $361 million. The leading export segment was photovoltaics with 69% of total sales ($25 million) followed by solar heating and cooling 7% ($7.4 million), wind 3% ($1.0 million), solar thermal electric 3% ($1.0 million), and supporting products and services 4%. Yet these figures represent only a tiny fraction of the international sales potential that is beginning to take shape.

The instances I have cited indicate clear trends pointing to serious problems ahead. The increasingly stiff, government-backed competition is laying the groundwork for carving out large market niches that U.S. companies will not be able to penetrate. Smaller U.S. companies especially will be left behind, unable to devote resources to the complexity of fighting the international competition.

It is in this light that we feel some government support for renewable energy export is essential in order to counter the claose support our competitors receive from their governments.

Recommended Actions

The Export Council for Renewble Energy supports action in several areas to help meet the international competition:

1. Continuation of the Program for Overseas Trade Shows. The International Market Development Program was sponsored by the Departments of Energy and Commerce in 1981, and has since died. It was one government program that attempted to alleviate some of the competitive disadvantages facing our industry in the international market.

During fiscal year 1981, the international market development program conducted a series of overseas trade shows and seminars which according to the recently released GAO report produced immediate sales of about $3 million and from which participants projected 12 month future sales of about $60 million.

The toal cost incurred by the Department of Energy in sponsoring this program was $500,000. The return on investment clearly indicates the cost effectiveness of such trade promotion events. When one takes into consideration that the total level of U.S. renewable exports in 1980 was $36 million, the dollar volume potentially generated by this first trade promotion had the effect of almost doubling American export sales. The fiscal year 1982 budget eliminated this very successful program.

The concept of cost sharing in the sponsorship of a joint industry/ government trade show had the most significant effect on middle and smaller size businesses who for the first time were able to participate in the international market.

A reinvigorated market development program for renewable energy products, under the aegis of the Department of Commerce, would represent the single most immediate and cost effective way to promote these products overseas. In addition the leverage of each tax dollar spent on such an effort will benefit our balance of trade and the growth of our industry.

We further recommend that $2 million be appropriated in 1983 to assist the renewable energy industry's participation in the Commerce Department's International Trade Administration (ITA) market development program. Through this program, ITA recruits companies for overseas trade fairs, sponsors -- on a government-to-government basis -- missions to foreign countries to bring U.S. renewable energy businesses face-to-face with prospective customers, and conducts seminars in this country to educate U.S. businesses on international marketing. These activities are conducted on a full cost-recovery basis; yet many renewable energy industries cannot afford the full cost of them. We are proposing, therefore, that the federal government share in the cost of these activities with renewable companies, on roughly a fifty percent basis, to permit the broadest participation possible among U.S. renewable energy firms.

In this regard, Mr. Chairman, we would hope that funds allocated to the Solar Reserve Account in the 1982 program, that were intended for international renewable energy market development activities, might be applied to ITA activities such as those listed above. Although originally $1 million was recommended for this area, we believe that no more than half of that amount is needed to support the activities that remain in the year. We would be happy to provide a detailed outline of the activities that this 1982 funding could be applied to.

These types of programs have proven to be surprisingly successful as door-openers for U.S. exporters. They offer means for U.S. sellers to meet key government officials and potential buyers, as well as potential joint venture and license partners. In addition, the participants receive a valuable in-country feel for the market.

Let me offer one example of the types of successes that can come from overseas shows. The United States provided a pavillion at the exhibition at the UN Conference on Renewable Energy in Nairobi last August. One company at the U.S. pavillion displayed its photovoltaic medical refrigerator. The company reports that more that 20% of its sales in this product line this year are directly attributable to its exposure in Nairobi.

2. Enactment of Export Trading Company Legislation. It is important that any exporter understand his market, how his product must be modified to fit that market and how to reach it properly and profitably. The addition of the banking community as a partner in the exporting process will strengthen the U.S. renewable industry and will result in the development of commercially successful marketing strategies. If the U.S. renewable industry is to remain competitive with Japanese, French, and German manufacturers, the U.S. banking community must be allowed to play the financial and strategic planning role their foreign counterparts are accorded by their respective governments.

3. Review and Coordination of Programs That Can Support Renewable Energy Exports. A host of government programs exist which either do or could play

a significant role in renewable energy exports. Each of them is designed to address different types of circumstances -- some address economic development needs of Third World countries, while others focus on U.S. commercial interests; some focus on direct sale exports from the U.S. while others deal with overseas investments. Taken together, if all these programs were activated and coordinated to help support renewable energy tade, the United States would have a powerful, flexible program to counter disadvantages that the U.S. companies now face in international trade.

To properly activate and coordinate these programs on behalf of renewable energy would require at least three initial stages: First, a conscious policy decision by the government (similar to the determinations made by the governments of our competitors) that renewable energy is of particular long range importance to developing countries and to our domestic interests, and therefore, deserves attention from each of the relevant programs. Second, a review of the strucure and criteria of each of the programs to assure that they can provide what is needed for renewble energy exports. Third, establishment of a clear focal point in the government for renewable exports which can keep some pressure on the separate programs so that, despite the varying missions of the programs, a concerted and coordinated approach is followed for supporting renewable exports.

We fully realize that this comprehensive approach is not a goal likely to be achieved very quickly. It is important, though, to begin the process of reexamining the major programs that could offer more focused support for renewable energy exports. These major programs include the following:

Export-Import Bank: Exim could hold the key to the ability for U.S. companies to offer competitive financing packages to foreign buyers. We strongly urge that careful review of the Bank programs be made in order to determine how export credits could be supplied for renewable energy export projects, and make the full range of Exim services could be made more accessible to renewable energy exporters.

Trade and Development Program: TDP serves the dual purpose of supporting U.S. exports to developig countries and supporting projects that are important for economic development in the developing country. It serves these purposes primarily through funding of feasibility studies for projects in LDC's. Renewable energy projects seem to fit naturally into TDP's dual mandate. However, the agency has funded very few renewables projects and has no plans for doing more in this area.

A major cause of TDP's inattention to renewables is probably its incredibly low funding level. The current progam funding level for TDP is $5 million. This is contrasted with comparable programs in the European Community which are funded at estimated $40-60 million. The comparable Japanese program is estimated to be funded at a level in excess of $100 million.

Because of the agency's very limited funding, TDP policies call for support only of programs with an extremely high, short-term pay back to the U.S.

economy in terms of first tier exports. Criteria for project approval include the likelihood of 100-to-1 payback in 2-5 years.. The presumption is that renewable energy projects are very unlikely to meet these requirements.

The feasibility-study funding services of the Trade and Development Program could be paricularly helpful to U.S. firms in meeting the government supported competition we are facing in developing country markets. Examination of TDP's project criteria ought to be made to see if more flexibility could be possible in order to allow funding of renewble energy projects. In adition, significantly higher funding should be made avialable to TDP.

OPIC: The Overseas Private Investment Corporation is designed to facilitate developmentally-sound U.S. investments in developing countries, primarily through political risk insurance, but also through direct lending and other services. Despite its mandate to place special priority on energy sector projects, OPIC hs given little attention to support of renewable energy investment projects. As with the Trade and Development Program, OPIC could play an important role in facilitating the presence of U.S. renewable energy companies in developing country markets, particularly as those countries increasingly seek local-value-added investments rather than direct sales from developed nations.

AID: In the past several years the Agency for International Development increased considerably its attention to renewable energy. However, a common reaction among industry representatives is that too often AID has focused on spurring cutting edge technology that is not commercially replicable, rather than facilitating the flow of currently available technologies or facilitating adaption of current tehcnologies to broad Third World needs. Careful attention should be given to seeing whether there might be ways to better incorporate renewable energy commerical interests with the development objectives of the Agency.

International Trade Administration: The Department of Commerce's ITA should establish renewable energy as a higher priority sector for export support. The program for overseas trade missions, for which we have urged reestablishment, would be housed in the ITA. By giving renewables higher visibility within the International Tade Adminstration, a natural result will be higher attention paid to this sector by the commercial attaches at the U.S. embassies. The range of foreign commerical services available can be quite helpful, particularly when priority attention is evident at the policy level.

An indication of the useful role that can be played by the commerical attaches occurred at the recent solar exhibition in Houston, held in conjunction with the American Solar Energy Society Conference. The commercial attaches were asked to stimulate interest among foreign buyers, and as a result more than 200 foreign buyers did travel to Houston.

Continued in-country work by the Commerce Department network, coupled with overseas trade shows and overseas missions of business and government officials would reap large and immediate rewards in terms of U.S. renewable energy sales. It is precisely this type of commitment that is making our foreign competition as successful as it is.

The Administration has consistently stated that the private sector should provide the solution to Third World energy needs. The renewable energy industry is ready and eager to provide a growing part of that solution for developing countries. But we will never be able to fulfill our role by ignoring the realities of the real world.

As it stands now, the real world of international marketing for renewable energy is one in which the U.S. will increasingly lose ground because it is not playing under the same rules as our competitors. We may not like those rules, but until they are changed -- and that will not happen quickly -- we must be prepared to put some of our own export support tools to better use on behalf of renewable energy. Failure to do so will preclude us from many long term international markets, and as a result will also impede our ability to grow sufficiently to meet the future needs of the domestic market.

Once again, Mr. Chairman, we deeply appreciate your willingness to bring these important issues to light.

UNITED STATES EXPORT COUNCIL on RENEWABLE ENERGY

Statement of Mission

The United States Export Council on Renewable Energy is established for the purpose of fostering the export of U.S. renewable energy technologies, products and services. ECRE is composed of leading U.S. renewable energy industry associations, and other national renewable energy organizations that demonstrate an interest in the promotion of U.S. renewable energy business activities abroad.

ECRE will serve as a focal point for the cooperation of the U.S. renewable energy sector with the U.S. Department of Commerce, other Federal agencies and international institutions on policy matters and specific programs affecting exports by the U.S. renewable energy industry. ECRE will also serve its members directly by providing information on international trade opportunities in renewable energy. In these ways, the Council hopes to enhance the U.S. position in the important and growing world market for renewable energy systems and technologies.

Initial members of ECRE:

American Wind Energy Association
Passive Solar Industries Council
Renewable Energy Institute
Renewable Fuels Association
Solar Energy Industries Association
Solar Lobby
Wood Heating Alliance

Mr. GORE. Mr. Charles F. Sills, please proceed.

Mr. SILLS. Thank you, Mr. Chairman.

I am a founder and vice president for International and Government Operations of Intersol Power Corp., and also a member of the international trade law project advisory panel of the Renewable Energy Institute.

I would like to discuss the topic before us somewhat in an anecdotal fashion. And this is based on several years' experience filing applications for and attempting to sell solar energy systems overseas.

For the last year I have represented a new and small solar corporation which is seeking foreign overseas markets for both large and small photovoltaic systems. We are talking about man-portable solar water pumps, all the way to football-field-size installations of sun-tracking, magnifying solar arrays. Previously I represented the solar section of a large U.S. aerospace company. So I have approached these problems of exporting and selling overseas from the perspectives of both a small new corporation and an established large multinational.

The main point that I would like to make or suggest is that the U.S. Government, in order to best promote American industries in this sector, in terms of exporting, should consider the creation of a subagency program with effective authority to initiate and support jointly with the private sector overseas technical training and technology transfer programs and, and this is important, the coordinated sales overseas of goods and services related to this technology transfer technical training.

Now, I am not afraid of technology transfer in the renewable energy field. I don't regard most of the processes, with the exception of course of solar cell technologies, as high tech. For the most part, renewable energy technologies are middle tech, which means that they are particularly appropriate for developing countries in terms of training a new generation of engineers and technical people.

As we all know, if you have engineers and technical people from these countries coming to American universities, and most important, American industries for internships and training programs, they will most likely go back and be more likely to purchase or want to purchase American components and American products. And I don't think this is being done in a concerted fashion.

When I attended the U.N. Conference on Science and Technology for Development in Vienna, in the summer of 1979 the State Department Deputy Representative, Princeton Lyman conducted a press conference in which he announced the intent to establish an American technical or technology transfer and technical aid institute or agency. And there was a great deal of attention given to this proposal at the conference.

The U.S. Government had already begun to offer jobs in the agency to people. Financing was planned, et cetera. Well, it never came about, for administrative and funding reasons.

But what I am suggesting is that this idea be revived and possibly established.

As Brad Mead has just mentioned, one of the main problems in the renewable energy and solar field is that there is a lack of coordination. What we have seen has been a kind of musical chairs, shifting of responsibility for assisting solar exports from the Energy Department to part of the Commerce Department, et cetera.

I would like to say for the record that I have nothing but praise for the people I have encountered in the U.S. Government trying to help in this area, for example, my company just had a booth at the International Technological Exposition in Houston 2 weeks ago and members of the Department of Commerce International Trade Administration, the foreign buyers program, were there, and although they were probably undermanned, they did an incredibly effective job, I thought, in vectoring foreign government and foreign commercial officials to particular U.S. wind energy, solar energy, and other companies at the show.

Now, this is very effective assistance, but it does not make up for the lack of export credits and subsidies which we have discussed before.

What I found personally in my overseas visits to energy establishments in other parts of the world, and especially developing countries, is a great impatience with the U.S. assistance programs.

For example, in Egypt, Egyptian solar energy planners term the U.S. approach the study-after-study approach. They do not see that the United States, despite the high amount of dollars allocated to the AID program in Egypt, they don't ever see an actual hardware or equipment program instituted. And I feel this represents a bias on the part of American assistance programs toward academic and individual consultants rather than an attempt to involve the U.S. private sector for expertise in the problems.

We need to get down to equipment and hardware projects that actually work in the developing countries.

Just a small example. There are several islands in Lake Nasser, which is the artificial lake created by the building of the Aswan Dam. The villagers on these islands earn their living mainly by fishing, but they can only fish one day out of seven because their fish will rot as there is no refrigeration plant to keep them fresh before the boat comes from the mainland one day a week.

A solar-powered refrigerator plant would solve the problem. The problem is, they do not have the money to extend the electric grid to the islands. This is one institution where you need an actual hardware project permitted by an American company, which the Egyptians would like to see but have never been able to get done.

Another example is Greece. The Hellenic Public Utility Corp. has specifically blueprinted plans for solar power stations to provide electricity to communities on 40 of the Greek islands. And they are waiting for financial and technical assistance to accomplish these projects.

The United States has not engaged itself in bringing private sector attention, or helping private sector industry into these projects, whereas the European Economic Community has already funded at a 75-percent level the first pilot project on a Greek island, and what I am afraid of, of course, is that the EEC will have most of the future business in this regard, and the United States will be left out.

What I am suggesting in terms of an American technical assistance subagency is the ability to go beyond what the Department of Commerce is now trying to do, and beyond what other programs have done in the past, and enter into a matchmaking function by literally matching potential projects overseas with American private businesses.

Now, the Office of Private Enterprise in AID has the capability but not the funding to move in this direction. The trade and development program has been mentioned before. And I agree with Mr. Heginbotham's testimony that the TDP is an excellent idea.

The problem is, it is only empowered to fund feasibility studies but not hardware and equipment. So that what we see is more funding of studies, and then once the study recommends that an actual equipment project be instituted, nobody has helped American industry obtain the export credit financing to be competitive in that country with that project.

Another specific example I would like to cite is Jordan. I have spent three visits in Jordan collaborating with members of the Royal Scientific Society, the National Planning Council, and other organizations there in working up a detailed concept for a 100-kilowatt solar powered water pumping and desalinization project in the Jordan Valley, south of the Dead Sea.

The purpose would be to provide potable water and irrigation for the villages in that area.

Unfortunately, Jordan does not have sufficient funds to finance this project itself, and although AID has been very helpful and philosophically willing to assist, the money for Jordan in AID, at least as I understand it, has been tied up for several years in an allocation for the large Magarin Dam project. But this project is not likely to get under way in the near future, because it has been checkmated by the political and resource dispute between Israel and Jordan over the Jordan River water supply.

So these funds, which have been allocated for Jordan, are tied up in a totally different project and are not available for the sort of technology transfer, technical assistance, and renewable energy sector programs which Jordan wants, and which American companies are ready to provide. This is a reason why I believe that a subagency dedicated to a kind of modest Marshal plan of technical assistance for the Third World, which I believe no industrialized country could perform better than the United States, would be able to focus effectively and closely on those technical assistance programs which particular countries want, and where American private sector industries can participate.

I think the renewable energy sector, because it is a new and very fast-growing area, is one where we should particularly focus on in terms of technical assistance.

Also, I do not oppose licensing arrangements per se for the sort of design and assembly of solar or wind energy or biofuels energy projects in the Third World which they want. What this means is that more and more U.S. companies could become involved in varying stages of on-the-ground assistance in setting up assembly plants, et cetera, in these countries, for increased local Third World country production of these decentralized energy systems.

This is what these countries need, because the more energy they can produce locally from, say solar installations, the less foreign exchange currency they have to pay for imported oil.

Before terminating this testimony, I would just like to point to some examples of the French Government support for their solar program as an example of one country which, in competition with us, has consistently helped its private industry.

COMES is the French Government agency responsible for assisting French industry in exporting renewable energy and specifically solar products to the Third World.

The French Government allocates about 10 percent of its renewable energy funding specifically for export assistance programs, and in the last 3 to 4 years they have lavished many millions of dollars on specific programs in the Sahel area of West Africa, the growth area, where those countries need in an immediate way solar assisted water pumping and irrigation services.

The French COMES officials have personally traveled with French industry delegations to over 50 countries in the Third World and set up bilateral assistance programs with about 18 countries.

More to the point, the French Government, in cooperation with French industry, has assisted in setting up renewable energy research centers in about five countries. And they have actually helped particular companies in placing their equipment for test evaluation in universities and technical centers in a variety of countries.

For example, Elf-Aquitaine is a large French company which had a product called the Sophocles solar concentrator cell system. Now, the French Government agency, COMES, has placed 8 to 10 of these prototype systems in different universities and technical centers in Africa, Asia, and Latin America.

What this means is that they are helping form the wedge into foreign markets for French renewable energy technical equipment. And I don't think this is a case of favoring one company over another, because COMES has helped most of the French companies in this section to this end.

I believe again this is what a United States technical assistance aid program could do, not favor one company above another in terms of breaking antitrust concepts or laws, but rather, giving a boost to the entire U.S. renewable energy sector, the private sector, so that the United States could be more competitive against French, Japanese, and other European countries.

Mr. Chairman, I would like to conclude my testimony and will be glad to answer any questions.

[The prepared statement of Mr. Sills follows:]

TESTIMONY PRESENTED BY CHARLES F. SILLS, VICE PRESIDENT FOR INTERNATIONAL AND GOVERNMENT OPERATIONS, INTERSOL POWER CORPORATION, TO THE SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS AND THE SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT, COMMITTEE ON SCIENCE AND TECHNOLOGY, UNITED STATES HOUSE OF REPRESENTATIVES, 17 JUNE 1982, ON U.S. SOLAR AND CONSERVATION TECHNOLOGIES IN INTERNATIONAL MARKETS.

Mr. Chairman, Members of the House Science and Technology Committee, I am Charles Sills, Vice President for International and Government Operations of Intersol Power Corporation, Denver, Colorado and Washington, D.C. I am also a member of the International Trade Law Project Advisory Panel of the Renewable Energy Institute.

I will address the topic before us, the competitiveness of American renewable energy products in the international marketplace, partially in an anecdotal fashion, based on several years experience finding applications for and selling solar energy systems overseas. For the last year I have represented a new, small solar corporation which is seeking foreign markets for both large and small photovoltaic systems -- from man-portable solar water pumps to multi-megawatt football-field size installations of pedestal-mounted, sun-tracking arrays used to power entire communities or villages; and for solar water heating and air-conditioning systems for hotels, hospitals, and factories. Previously, I represented a large aerospace company in its international solar sales. Thus, I have seen the overseas marketplace from the perspective of both a large and small American exporting company.

From this experience my conviction is that although American renewable energy products are probably still more advanced technically and more useful in terms of developing countries' present and near-future needs, American companies are at a significant disadvantage vis-a-vis European - mainly French, German, Italian, and British - competitors. The Japanese companies engaged in solar energy R&D and product development have not yet attempted to penetrate the international marketplace on a large scale but are expected to do so in the near future. Previous testimony before other committees has spotlighted the advantages European renewable energy companies hold over U.S. companies, primarily due to the various types of export credit subsidies granted by European governments. These supports for European exports vary from country to country and transaction to transaction but include a variety of government sponsorship of R&D and demonstration programs, less restrictive country and credit risk criteria, local cost financing, foreign content insurance coverage, inflation indemnity, exchange rate fluctuation insurance, and so forth.

U.S. trade support agencies, such as Eximbank, have only been able to go part of the distance in closing this competitive gap. The U.S. simply has not organized a comprehensive program of tied aid and export credit financing on adequately concessional terms. The U.S. renewable energy sector is in fact a critical industry sector which shows great potential for increased exports. I have nothing but praise for several U.S. government programs which are attempting to close this competitive gap with Europe and which have specifically aided U.S. solar exports. For example, the Department of Commerce Foreign Buyers Program in the International Trade Administration was represented well and agressively at the International Solar Energy Exposition at Houston, which I just attended, and they accomplished a great deal with limited manpower resources in the way of introducing overseas government and commercial customers and buyers to U.S. solar, wind and biofuels companies exhibiting or represented at the show.

Similarly, I have found great receptivity on the part of the Trade and Development Program and several specific sections of the Agency for International Development in assisting U.S. companies reach overseas customers and markets. The concept of the Trade and Development Program in particular should be applied, I believe, on a wider basis, that is, the TDP Program concept of financing feasibility studies leading to larger future equipment or hardware contracts should definitely be one of the components of a comprehensive U.S. renewable energy export assistance program. Similarly, the Overseas Private Investment Corporation has sponsored several extremely well-conceived and executed overseas marketing missions where U.S. businesses pay a fee for introductions to host country government and commercial customers.

What is lacking in my opinion has been coherence and consistency in these programs. There has been a musical chairs sort of switching from one agency to another year by year in terms of which agency has primary responsibility for assisting American solar and renewable energy companies in the overseas marketplace. Originally, the International Market Development Program of the Department of Energy was responsible for this function, but the recent budget cuts abolished that office last fall. Many of its functions have been nominally passed to the Commerce Department but again the offices in DOC which are responsible for and indeed try their best to assist the U.S. solar industry have other responsibilities in other industrial sectors and cannot be expected to formulate a full-scale specifically tailored export promotion program for this particular industry. The newly created Office of Private Enterprise in AID could well be a focal point for a comprehensive program, but as I understand it, their funding is limited and they must coordinate with the regional AID bureaus to obtain funding for specific programs. Too many times I have found, while on marketing trips in Egypt, Jordan, Greece, the Caribbean, etc., that AID offices are willing and eager to disseminate information on American renewable energy industries and products but they have no line decision authority in terms of making agreements with host country officials for the planning or commencement of specific projects. Project approval must go through an extremely complicated six to eight month cycle in Washington before anything can be implemented.

There is also the preference within the U.S. Government to turn to academic centers and individual professional consultants rather than to private sector corporations to accomplish renewable energy projects in developing countries. This reflects a certain in-bred adversarial attitude on the part of certain agencies, a fear of giving unfair advantage to specific companies. I believe that this can be avoided by the cooperative promotion of the American renewable energy industrial sector as such, rather than promotion of any one specific American firm.

In the American assistance program, there is too often funding of progressive layers of feasibility studies, instead of a funding commitment for immediately useful hardware and equipment projects. For example, I encountered great discouragement on the part of Egyptian solar energy planners with what they termed the "study after study" approach of the U.S. AID program. Similarly, in Jordan, the Royal Scientific

Society the highest praise for the West German technical assistance program. Although the Germans had installed a rather inefficient solar power desalination plant on the Red Sea at Aqaba, nearly all the cost of this construction and the associated technical training programs were borne by the German Technical Aid Agency. There is a strong preference on the part of most developing country government and commercial officials for American technology; but they are not hesitant to express their admiration and gratitude for the swiftness and efficiency which they see on the part of the Germans, French, and other European government assistance programs in funding and implementing specific visible and usable equipment and training programs in their countries.

I believe that what we need is a United States Government -- or half-Government, half-private -- agency which could operate with semi-autonomy and swiftness in terms of implementing projects overseas, and matching American industrial firms with potential joint venture and licensing counterparts in those countries, equivalent to those agencies already operating successfully in the European countries. When I attended the United Nations Conference on Science and Technology for Development (UNCSTD) in Vienna in the summer of 1979, Princeton Lyman held a press conference at which he announced plans for the establishment of a United States technical assistance agency, essentially an agency which would attempt on a modest scale a kind of

Marshall Plan technology transfer operation vis-a-vis the developing countries. The aim was to promote U.S. industries while assisting developing countries in those technologic and economic and infrastructure areas where they most sorely needed a boost; this would involve substantial training of developing country engineers and technicians in not only American university centers, but also in American industries. As we know, this is one of the best ways to familiarize overseas scientific and technical people with American products, because they will ultimately want to purchase those products on a large scale for projects in their own countries. Unfortunately, due to funding and policy problems, this agency was never created. I believe now is the time to do so.

At the United Nations Conference on New and Renewable Energy Sources in Nairobi last summer, the U.S. opposed increases in multilateral energy aid or the creation of a World Bank energy affiliate. Instead, the American position was that private industry should be encouraged and supported to fill the gap in renewable energy technologies in the developing world. I fully agree with this basic Administration philosophy; however, it must be given some teeth to succeed. The way to do this is not the announced U.S. intention to double AID's bilateral funding for new and renewable energy development, because that does not solve the internal bureaucratic lag time inherent in Government-only programs. It does not focus specifically on fast commercialization, that is, industrial project use of solar and other renewable energy equipment

and it does not insure that American companies will in fact get the contracts that AID money is dispensed for. One area which would be treated well by a technology assistance agency would be how to get small and medium sized businesses into the overseas market; that is, how to match them specifically with foreign government and commercial organizations which need their particular products. A well-managed technology transfer program could focus on this area and create a computerized pool of American companies and products and could act as a matchmaker for this particular industrial sector.
Here I am going beyond the basic Department of Commerce functions which include market analysis, export seminars for U.S. companies, and product exhibitions and seminars overseas, to a specific joint venture matchmaking function.

It is not only small companies which need this kind of help. Even the larger solar companies in the U.S. or those solar companies which are small parts of large aerospace or conventional fuel companies need specific introductions in the Third World to compete with Europe and Japan. This is especially true because the renewable energy industry is a new and rapidly expanding industry in the world, and in most cases, you make your markets as you go along, that is, you suggest to potential commercial collaborators in overseas countries how solar equipment -- for example, photovoltaic equipment generating rust protection for oil and gas pipelines --

can be utilized and fit cost-effectively into particular projects and programs.

Another way in which such an agency could assist U.S. renewable energy exports is the direct links it would have with R&D development funding programs within the U.S. Government. That is, it could recommend that technology development funds be put into certain products which are known to be needed in particular overseas environments, for example, compact solar powered desalination equipment, more efficient solar powered DC water pumps, and so forth.

Unlike the previous bilateral technical cooperation agreements, such as the ones negotiated by the U.S. Department of Energy with Greece and Italy, this technical assistance agency would develop a standard formula for commercial and industrial cooperative technical programs with developing countries and each agreement would not have to be laboriously negotiated on an ad-hoc basis. In too many cases, U.S. technical assistance funds have been tied up in other industrial areas. For example, I visited Jordan on three separate occasions, and in collaboration with officials of the Royal Scientific Society, the National Planning Council, and other organizations, jointly developed a project concept for a 100-kilowatt brackish water pumping and desalination program powered by a photovoltaic concentrating system to be sited in the Jordan Valley 50 kilometers south of the Dead Sea. The purpose was to provide potable water and irrigation for the villages in that area. Jordan is also interested in becoming a renewable energy technology center for its region. A second project, solar-powering Yarmouk University, Jordan's huge, new technical education center, was discussed since, although Japanese architects designed the University, Japan at that time was unable to provide the working high-concentrator solar arrays to provide adequate power for the complex. Unfortunately, there was no U.S. assistance money of any sort forthcoming, primarily because the AID money allocated for Jordan had been specifically tied to the Maqarin dam project, which in turn had been tied up for several years because of the political and territorial dispute between Jordan and Israel over the Jordan River water supply; this money was not likely and is still not likely to be released soon.

Another example where projects have been conceived in detail but funding has not been available is Greece where the Hellenic Public Power Corporation wants to install not demonstration but working solar power systems on various islands to provide electricity for the island communities -- which because of their remote location from the mainland are not tied into the Greek National electric grid, and petrol is prohibitively expensive as it must be shipped to the islands. Greece has a detailed blueprint plan for a solar city on the Island of Crete which could involve as much as ten megawatts of solar equipment; but it is likely that the European Economic Community will negotiate contracts for this project before the U.S. pays sufficient attention to it. The EEC is already involved with Greece in a 50-kilowatt photovoltaic demonstration program which involves 75% EEC funding.

France is undoubtedly becoming the leader in terms of the extent of solar market penetration into the Third World. More than 10% of France's national solar energy budget is devoted to international programs, coordinated by COMES.

In the 1979-81 timeframe, COMES (Commissariat a l'Energie Solaire) extended $6.8 million in aid to eight West African countries to develop renewable energy projects. This program, called the "Sahel Energies Nouvelles" program, covers activities in Senegal, Mauritania, Niger, Chad, Cameroon, Upper Volta, Mali, and Cape Verde Islands. Projects using hybrid solar/wind technology have been started in Mauritania and Senegal, and wind generators using equipment manufactured by Aerowatt, a subsidiary of the French Atomic Energy Commission, are being installed in Senegal, Mauritania, Niger, and Cape Verde.

The Sahel program encourages local manufacture of solar system components; Mali and Senegal have begun the production of solar flat-plate collectors. Current projects include:

-- An 80 kW solar thermal collector pump and electricity generating project at Dire, Mali.

-- 2 250 kWh/day solar collector powered electricity plants in Senegal and Niger.

-- A 5 kW aerogenerator at M'Boro, Senegal.

-- A 10 kW photovoltaic generator at a hospital at San, Mali.

-- 30 solar, wind, or hybrid pumping stations in Mali with generating capacity varying from 500 W to 5 kW.

In all, COMES officials have visited over 50 developing countries, and are reported drafting agreements to provide assistance for solar projects in Egypt, Saudi Arabia, India, Indonesia, Mexico, Thailand, Algeria, Tunisia, United Arab Emirates, and Qatar.

A 1978 agreement with Egypt has been extended to 1983 for France to provide solar water heating equipment and to license Egyptian companies to make French-designed components. An ELF-Aquitaine SOPHOCLE concentrating collector is to be installed at the Riyadh Engineering College, as part of a desert area photovoltaic test program.

Solar centers are being set up with French aid in India and Indonesia, and COMES is looking into cooperation agreements with OLADE (the Latin American energy organization based in Quito, Ecuador) and with the West African Economic Community. COMES allocated $2.8 million in 1978-80 to Polynesian projects, and funding has been increased to $3.5 million/year in 1981: Construction has already been completed on a number of solar/wind/water pumping plants, solar air-conditioning systems, and wind generators.

What is important to note here is that in these overseas projects, COMES -- a French Government agency -- works closely with French solar firms for maximum market penetration. For example, under COMES sponsorship, ELF-Aquitaine's SOPHOCLE concentrator module system is being tested -- and promoted -- at solar research centers in eight countries outside France:

LOCATION/COUNTRY	ORGANIZATION TESTING SOPHOCLE EQUIPMENT
Algiers, Algeria	Center for Science and Nuclear Technology
Rio de Janeiro, Brazil	C.O.P.P.E. - Federal University of Rio de Janeiro
Libreville, Gabon	Omar Bongo University
Athens, Greece	Electronics Laboratory, Department of Physics, University of Athens
New Delhi, India	Indian Institute of Technology
Merida, Mexico	C.R.E.G.I.T. - Regional Technological Institute of Merida
Dakar, Senegal	University of Dakar
Bangkok, Thailand	Asian Institute of Technology

I have cited these detailed examples in an effort to document the fast-growing renewable energy products market overseas, and in the developing countries in particular; and to suggest that the United States Government, in order to best promote American industries in this sector, should consider the creation of a sub-agency program with effective authority to initiate and support, jointly with the private sector, overseas technology transfer programs and the sales of related goods and services.

This completes my prepared testimony, Mr. Chairman. I will be pleased to furnish any additional background information you may request, and I would be glad to answer any questions you might have at this time.

CHARLES F. SILLS

Biographic sketch

Charles F. Sills is a Founder and Vice President for International and Government Operations of Intersol Power Corporation, a Denver, Colorado and Washington, DC firm engaged in developing a wide range of solar energy systems for heating and electrical needs in the U.S. and developing countries, including power for remote villages, water-pumping and irrigation, factories, hospitals, hotels and other facilities not powered by conventional fuel. He was previously director of international solar programs at Martin Marietta Aerospace headquarters, and assisted in establishing the U.S.-Saudi Arabia Joint Economic Commission "Solar Village" project near Riyadh, the world's largest photovoltaic installation. He is a member of the Renewable Energy Institute's Trade Law Project Advisory Panel, and a consultant to the Institute of International Environment and Development's program on private sector initiatives in the developing countries. Mr. Sills holds an M.A. from the Fletcher School of Law and Diplomacy and an A.B. from Princeton University.

Mr. GORE. Thank you very much. Two fascinating and helpful statements.

I believe that both of you attended the recent Houston Conference, is that correct?

Mr. MEAD. Yes.

Mr. SILLS. Yes, Mr. Chairman.

Mr. GORE. I understand that there was, at that conference, talk of a new breakthrough in amorphous silicon resulting in a cost figure that sounds awfully exciting. Do you know anything about this? Could you enlighten us on it?

Mr. Mead?

Mr. MEAD. Charles is the expert on photovoltaics.

Mr. GORE. Mr. Sills?

Mr. SILLS. I will say what I can. I am not an engineer. The solar cell technology is not my forte.

From what I have heard, I believe there is one U.S. corporation, the Kronar Corp., which claims to have made some breakthroughs in photovoltaic semiconductor material manufacture. They say they have gotten the cost down.

I believe they have some sort of ribbon system. I am not positive about this. I cannot speak for them. But they do have plans to set up manufacturing facilities for photovoltaic cell materials in developing countries.

I believe their first installation will be in Morocco. But again, I am not sure exactly of their business plans. I do not know their prices, but they say they have brought the prices down.

Mr. GORE. The figure that filtered back to us was 12 cents per kilowatt hour. Can that be true?

Mr. MEAD. Mr. Chairman, this industry is full of entrepreneurs who make a lot of statements and give cost numbers that many times don't pan out. I would be very skeptical of any numbers that were below a dollar at this point, short of actually seeing the systems for sale for that price.

Mr. GORE. Well, I was quite skeptical when I heard that. I knew both of you had attended the conference. I am hoping against hope maybe in this case the skepticism is not warranted.

I appreciate your cautionary advice. It is an approach that we have learned to adopt here as well.

Mr. MEAD. I think when you get a price and delivery time out of the people, then I think you are close to getting rid of the skepticism.

Mr. GORE. Well, we wish them the best. I certainly hope that their claims will turn out to be accurate.

Mr. Mead, I am interested in the estimates of benefits from trade shows of 100 times the investment. I have always wondered whether those estimates were not to be taken with a grain of salt. The numbers come from questionnaires that participants fill out at the end of the trade show.

To my knowledge, a followup is never undertaken.

Do you have any feelings about those estimates?

Mr. MEAD. I was a participant in most of those trade shows, representing Grumman. I think you are right. I think it is always difficult to understand exactly how these numbers were arrived at.

GAO is pretty careful in trying to be specific in their questions. I don't have any doubts that over a 2- or 3-year period there is 100 times return on the money that was invested. I think there is a much more important issue, and that is that we are establishing American companies, for the first time, in overseas markets in this industry in particular, which may have some repercussions later on in other industries.

The cost-benefit analysis for establishing somebody for the first time in what will be the most lucrative and largest market in the world, the international market, I think it is a little difficult to judge also. I know about the returns in 12 months that American companies actually experienced, since we did a followup phone survey on that—not part of the GAO report. Most of them were conducting business, doing exports.

Since they had to pay half the freight on the actual shows, we asked, if that program came alive again would you go in on it. They all said absolutely yes, because it took American companies into the field and allowed the problem solvers to see what the problems were and to see whether they could compete. In most cases they say they could, but they had to get there first and understand the market a little better.

I don't have any doubts that the benefit-cost ratio is in excess of 100 to 1. Whether it is that in 12 months or not is to be debated.

Mr. GORE. Do you want to comment, Mr. Sills?

Mr. SILLS. I would just like to say I agree with Brad. I think the trade shows are effective. I think that the Department of Commerce's traveling seminars, where they take representatives from certain companies on a two- or three-country visit and set up panels and seminars and introductions to specific industry and government people—tailored introductions in those countries—is also a very good way of promoting exports. It is not a trade show, but it is a traveling U.S. visiting delegation with specific meetings.

Mr. GORE. Do you believe it is more important for the Government to support research in this technology, or to support exports, or both?

Mr. SILLS. I think both. I think they go hand-in-hand, Mr. Chairman.

Although I think that the research that the Government, given limited resources should be supporting, research into product development, technology and product development, for those sorts of solar or wind or biofuel systems which are likely to be exportable. I think this would strengthen the industry and bring in more profit so that the companies can put their own money into R&D eventually.

What we are trying to do is like launching a rocket into the atmosphere. We are using up a lot of fuel in the first stages to get it launched. And I think if the Government would put more funds into project development, technology development, for exportable products, this would have a return to the industries which could enable them to do their own R&D more and more.

Mr. GORE. Would both of you be willing to answer additional questions for the record? We have a number that other members of the subcommittee would like to put to you.

Mr. MEAD. Yes.

Mr. SILLS. Yes.

Mr. GORE. I think both of your statements have been particularly good and particularly useful to us, because you are right on the frontlines, watching it every day. Our next hearing in this series is Monday.

I want to thank you both for helping us in this effort.

Until Monday, the subcommittees will stand adjourned.

[Whereupon at 12:30 p.m., the subcommittees adjourned, to reconvene Monday, June 21, 1982.]

U.S. SOLAR AND CONSERVATION TECHNOLOGIES IN INTERNATIONAL MARKETS

MONDAY, JUNE 21, 1982

House of Representatives,
Committee on Science and Technology,
Subcommittee on Investigations and Oversight,
Washington, D.C.

The subcommittee met, pursuant to call, at 9:30 a.m., in room 2325, Rayburn House Office Bulding, Hon. Albert Gore, Jr., presiding.

Mr. **Gore**. The subcommittee will come to order.

I would like to welcome all of our witnesses and guests this morning.

It is a pleasure to welcome you this morning to our hearing on U.S. solar and conservation technologies in international markets. This is the final hearing in a series of three held this month on this subject.

This hearing was originally scheduled to be a joint hearing with the Subcommittee on Energy Development and Applications, chaired by Don Fuqua, but due to conflicts in schedules we had to hold this hearing on a day when Chairman Fuqua's subcommittee was itself holding a hearing in Pittsburgh.

This hearing continues the focus of the hearing held last Thursday, which was the examination of U.S. programs to support and promote the sales of U.S. energy conservation and renewable energy technology products in international markets. As was brought out Thursday, many of the problems facing the export of these technologies are generic to small- and medium-sized industries who want to develop the export market.

We also heard testimony that America is gradually losing its leading position in technology as a direct result of failing to develop the international markets. Today we will hear from administration witnesses about programs which could directly support export of energy conservation and renewable energy technologies.

I would like to welcome our witnesses.

The first panel is made up of Jack Vanderryn, Director for Energy and Natural Resources at the Bureau for Science and Technology in the Agency for International Development here in Washington; John Hardy, Deputy Assistant Administrator of the Trade and Development Program, and Gerald T. West, Vice President, Office of Development, Overseas Private Investment Corporation.

Gentlemen, if you would come forward to the witness table, I would like to welcome you.

Without objection, the entire text of the prepared statements you have submitted to the subcommittee will be included in full in the record. We invite you to proceed in any way you see fit.

Mr. Vanderryn.

STATEMENTS OF JACK VANDERRYN, DIRECTOR, ENERGY AND NATURAL RESOURCES, BUREAU FOR SCIENCE AND TECHNOLOGY, AGENCY FOR INTERNATIONAL DEVELOPMENT; JOHN HARDY, DEPUTY ASSISTANT ADMINISTRATOR, TRADE AND DEVELOPMENT PROGRAM, AND GERALD T. WEST, VICE PRESIDENT, OFFICE OF DEVELOPMENT, OVERSEAS PRIVATE INVESTMENT CORPORATION

Mr. **Vanderryn**. Thank you, Mr. Chairman.

Mr. Chairman, I am pleased to appear before you today as Agency Director for Energy and Natural Resources to discuss AID activities which contribute to the expansion of markets for U.S. products and services in solar and renewable energy and energy conservation.

The principal goals set forth in the Foreign Assistance Act provided the point of departure for our planning and programs:

One, alleviation of the worst physical manifestations of poverty among the world's poor majority;

Two, the promotion of conditions enabling developing countries to achieve self-sustaining growth with equitable distribution of benefits;

Three, encouragement of development processes in which individual civil and economic rights are respected and enhanced.

And four, integration of the developing countries into an open and equitable international economic system.

AID's energy programs recognize the dual dimensions of the energy problem in most developing countries—heavy dependence upon imported oil, and diminishing fuel wood supplies to meet accelerated demand.

Our energy goals are to ease the immediate constraints to development and to help developing countries make the difficult transition to a mission of energy sources and related strategies that will sustain their economies.

Our energy technical assistance programs are tailored to the requirements of individual countries, and emphasize analysis of developing country energy needs, uses, resources and policies; training and institutional development; site testing and demonstration of new technologies, and lastly, increasing energy supplies, both conventional and renewable.

From a funding level of $18 million in 1978, AID energy activities grew to $49 million in fiscal year 1981. This year expenditures of about $72 million are projected—not counting an additional $30 million in energy projects covered by the economic support fund. About 47 percent of the development assistance in energy, or $34 million, is allocated for renewable energy projects. Fuel wood activities account for an additional $19 million. Projects in fossil fuels account for the balance of $18 million.

I would like to cite some examples of how, in extending technical assistance in renewable energy and energy conservation, AID helps to increase the U.S. export potential to developing countries and promotes growth of the private sector in these societies.

Several years ago, AID recognized the potential of photovoltaics in the Third World, because of their suitability for remote, low-power applications in locations not accessible to a central electricity grid. The less developed countries represent the largest potential market for U.S. photovoltaic manufacturers.

Our accomplishments since 1979 in evaluating the capability of photovoltaic technology to meet rural electricity needs in the developing world provide an excellent illustration of how the agency can help American industry open up new foreign markets for energy products.

Our project manager for this work has been the NASA/Lewis Research Center in Cleveland, a pioneer in photovoltaic research and development since 1960.

Our initial pilot project provided a 1.9 kilowatt photovoltaic unit to power a water pump and small mill for grain grinding in a village in Upper Volta. Equipment procurement was by competitive bid from U.S. suppliers. Photovoltaic modules later doubled in capacity to 3.6 kilowatt which were bought from Solarex Corp. and Sensotech Corp. NASA's field tests enabled the manufacturers to modify system components to significantly improve their reliability. With increased volume, improved production techniques and further technological advances, lower prices will make photovoltaics increasingly competitive in remote locations.

In Tunisia, we expect to begin operation this year of a photovoltaic power system integrated with wind and solar heating units in a small village 80 miles southwest of Tunis. The Solar Power Corp. of Woburn, Mass., is installing the 10- to 20-kilowatt system. At another remote Tunisian site, two 600-watt systems will power-drip irrigation for a greenhouse and orchard. U.S. manufacturers, through such demonstrations, will be positioned to rapidly exploit the market potential in rural power to the Third World.

At 18 remote sites in developing countries, AID is cooperating with the Department of Energy and the Atlanta Center for Disease Control to field-test photovoltaic-powered refrigerators for the preservation of vaccines. To evaluate the medical refrigerators under varying conditions in developing countries, the Lewis Center purchased 10 units from the Solar Power Corp., and 10 from Solavolt International, with photovoltaic arrays procured from Solarex.

As a direct result of these field tests, the Inter-American Bank asked Solarex to consider replication of these systems.

The Solar Power Corp. has sold a number of medical refrigerators as a result of this project and plans to tap the global market for high quality medical refrigerators which it estimates will be 60,000 units within this decade.

AID has funded photovoltaic-powered electricity supplies for rural health clinics in Ecuador, Guyana, Kenya, and Zimbabwe. Clinics are well-suited to photovoltaic power since they require modest amounts of electricity from a reliable source. Solar power could thus lead to marked improvements in the effectiveness of rural health delivery. The three U.S. manufacturers supplying the equipment foresee a sizable market for applications in developing countries.

Demonstrations such as I have mentioned help activate the latent worldwide market. Photovoltaics conceivably could become the least expensive and most reliable power source for selected decentralized applications in developing countries.

Turning now to small hydropower, our assistance work there also leads to increased U.S. exports. We sponsor resource surveys and site feasibility studies for decentralized water power installations. The National Rural Electric Cooperative Association, in NRECA, with AID funding, arranges for U.S. experts to conduct in-country studies. Their frequent use of specialists from U.S. industry makes available to the LDC's outstanding U.S. expertise, and at the same time provides our private sector with exposure and access to potential markets.

Orders for American turbines, generators and control equipment are resulting from these AID-sponsored activities. For example, NRECA assisted the AID mission in Thailand to develop an $8.1 million project involving procurement of U.S. small hydropower equipment for 12 demonstration sites.

NRECA recently published and distributed to over 70 developing countries a directory of all U.S. turbine manfufacturers listing equipment specifications. Technical specialists from U.S. manufacturers have participated in AID-sponsored regional workshops on small hydropower held in Latin America, Asia, and Africa. Through these types of AID-sponsored activities, U.S. firms are establishing new relationships with energy planners and engineers in developing countries.

In addition, at AID's request, NRECA is organizing a 2-day workshop in Washington June 28 to 29 to which more than 20 U.S. manufacturers of small hydropower equipment will be invited. We hope to identify innovative ways in which U.S. enterprise can improve its competitive position abroad and, conversely, explore how industry can contribute to strengthening U.S. development assistance activities.

We are also active in the bioenergy field. In the Philippines, several approaches for conversion of wood to energy will be tested. Within a year, a U.S. manufacturer will receive a contract to supply three 5-megawatt wood-fired boilers and electric generators. U.S. industry will have an opportunity to demonstrate the quality and competitiveness of its boilers and electric generators in the Philippines market that alone is predicted to exceed 100 units within 8 years, a market of about $400 million.

The Philippines project is also expected to result in the procurement of 1,000 charcoal-burning gasifiers from U.S. manufacturers within the next 3 years at an estimated total cost of $2.6 million.

The overall market should be substantially larger. Philippine manufacturers hopefully, in joint ventures with U.S. firms, are likely to produce these gasifiers.

Similar bioenergy projects designed to tape indigenous supplies of wood and charcoal to meet energy needs in both the traditional and modern sectors are under development with AID assistance in Indonesia, India, the Dominican Republic, and Honduras, among others.

We plan in the bioenergy area to sponsor a workshop with U.S. industry early this fall to examine developing country markets for bioenergy technology, and the potential for industrial services and American products in this field.

In areas such as wind, geothermal and solar thermal, the agency has found more limited opportunities to further the commercialization of renewable energy techniques. Several years ago, AID invested upwards of $5 million in underwriting the initial geological and geophysical surveys of the geothermal potential in the Philippines. This has resulted in the Union Oil Co. of California to invest substantially in geothermal power production with long-term contracts to supply electricity in the Philippines.

With a projected expansion to 900 megawatts of capacity, the Philippines could become the world's second largest producer of geothermal generated power.

AID is joining other organizations in funding workshops in New York, Jamaica, and Kenya, which will seek to stimulate new initiatives in renewable energy development by the U.S. and Third World private sectors.

Case studies illustrating innovative successful business ventures involving renewable energy technologies will be presented and policy actions required to facilitate private enterprise by governments in both developed and developing countries will be considered.

If I can turn briefly now to energy conservation assistance, we are also active in this area.

Recent AID-funded studies in Haiti and Sri Lanka, countries with among the world's lowest per capital incomes, reveal that considerable conservation potential is available in industry, transportation and large commercial buildings.

We plan to assist such oil-importing developing countries to undertake energy audits of industrial plants, buildings, transportation systems and other uses. The audits will be performed by U.S. contractors.

AID assistance in energy conservation activities undoubtedly will lead to procurement of equipment and services from U.S. industry.

A significant market of as yet undetermined size exists for retrofitting energy production and utilization systems in developing countries.

The U.S. private sector should be prepared to take advantage of this opportunity as it develops. For example, in Jamaica, the Ministry of Mining and Industry, with AID help, is undertaking a $2.7 million energy audit of industry, commercial buildings, hotels, hospitals, and transportation facilities.

Major hotels and hospitals will be retrofitted using alternative energy sources such as solar, water heaters, and cooling systems.

May I discuss now AID's mandate?

Section 601 of the Foreign Assistance Act declares that it is the policy of the United States, and I quote, "to encourage the efforts of other countries to increase the flow of international trade, to foster private initiative and competition, and to encourage the contribution of U.S. enterprise toward economic strength of the less-developed friendly countries through private trade and investment abroad."

In its new emphasis upon the role of the private sector in development assistance, one of AID's underlying goals is to create an environment of economic opportunity conducive to the advancement of indigenous business enterprise. Private enterprises in developing countries produce jobs, foreign exchange, and a base of managerial and technical skills. All these are essential to meet the needs of the poor majority.

The bulk of funding for AID private sector activities is our bilateral country programs through the normal programing process. Our field missions identify and justify private sector projects in the same way as for activities in other sectors.

The Bureau for Private Enterprise was established last year in AID to function as a catalyst to advance the private sector initiative throughout the agency. In an effort to test new and cost-effective methods of facilitating projects that will strengthen indigenous private sectors in Third World countries, the Bureau adopted several basic operating principles. It seeks ways to stretch limited AID funds by attracting the resources of others—private sectors in the United States and developing countries, commercial banks, and multilateral lending institutions.

A primary area of concentration is inspiring and facilitating joint ventures between American and indigenous LDC firms. Such joint ventures would transfer technology and skills and provide financial support to developing countries while opening up opportunities for U.S. companies.

In summary, Mr. Chairman, through AID technical assistance programs in energy, which are directed toward addressing the development need of the LDC's, U.S. private sector interests are advanced in a broad and diverse number of ways, U.S. industries involved in AID development assistance activities. This makes use of U.S. industrial know-how to assist the LDC's solve their energy problems and at the same time provides our industry opportunities to become familiar with and explore developing country markets. Hardware and technical consultants for AID-funded projects are procured from U.S. suppliers.

Workshops and conferences funded by AID provide new contacts between U.S. industry and developing country energy personnel. AID projects field-test U.S. energy products in order that they can be adapted and modified for Third World applications.

Developing country markets for renewable energy and energy conservation technologies are identified in the course of the agency's technical assistance programs. AID-supported conservation surveys and energy audits point up the need for new machinery and equipment. Where possible, U.S. products and capabilities are demonstrated.

AID training programs in renewable energy technologies serve to establish contacts between the LDC participants and U.S. industrial representatives.

And lastly, directories, catalogs, and specifications of American-made equipment are circulated to developing countries by AID and its contractors.

We believe that renewable energy technologies will play an increasing role in developing countries over time.

In this area as well as in conservation we are working closely with our industry. AID's activities offer significant encouragement and support to U.S. industries in accessing the developing country market potential.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Vanderryn follows:]

STATEMENT ON

A.I.D. PROGRAMS IN SOLAR ENERGY AND CONSERVATION AND THEIR CONTRIBUTION TO INTERNATIONAL MARKETING

BY

DR. JACK VANDERRYN
Agency Director for Energy and Natural Resources
Bureau for Science and Technology
Agency for International Development

BEFORE

THE SUBCOMMITTEES ON OVERSIGHT AND INVESTIGATIONS AND

ENERGY DEVELOPMENT AND APPLICATIONS

OF THE

COMMITTEE FOR SCIENCE AND TECHNOLOGY

UNITED STATES HOUSE OF REPRESENTATIVES

June 21, 1982

Mr. Chairman and Members of the Subcommittees, I am pleased to appear before you today as Agency Director for Energy and Natural Resources to discuss A.I.D. activities which contribute to the expansion of markets for U.S. products and services in the fields of solar and renewable energy and energy conservation.

Let me begin by describing for the Committees the general policy framework within which A.I.D. is currently working. The principal goals set forth in the Foreign Assistance Act provide the point of departure for our planning and programs:

-- the alleviation of the worst physical manifestations of poverty among the world's poor majority;

-- the promotion of conditions enabling developing countries to achieve self-sustaining growth with equitable distribution of benefits;

-- the encouragement of development processes in which individual civil and economic rights are respected and enhanced; and

-- the integration of the developing countries into an open and equitable international economic system.

In the energy field, A.I.D. programs recognize the dual dimensions of the energy problem in most developing countries -- heavy dependence upon imported oil and diminishing fuelwood supplies to meet accelerated demand.

A.I.D.'s energy policy goals are to ease the immediate constraints to development and to help developing countries make the difficult transition to a mix of energy sources and related strategies that will sustain their economies.

A.I.D. programs in energy are tailored to requirements of individual countries and seek activities where Agency programs can stimulate investment. Our technical assistance in energy is concentrated in the following areas:

-- analysis of energy needs, uses, resources and policies;

-- training and institutional development;

-- site testing and demonstration of new technologies; and,

-- increasing energy supplies, both conventional and renewable.

A.I.D.'s energy policy has increasingly recognized the importance of pricing as an allocation mechanism for the availability and kinds of energy supplies. Sound developing country policies, especially realistic pricing, are indispensable to creation of a climate favorable to foreign and domestic private investment, increased production and improved efficiency of energy use.

From a level of $18 million in FY 1978, A.I.D. energy activities grew to nearly $34 million in FY 1980 and $49.million in FY 1981. This year obligations of about $72 million are projected, in addition to $30 million in energy projects covered by the Economic Support Fund. Nearly half of A.I.D. development assistance in energy, $34 million or 47 percent, is allocated for renewable energy projects. This excludes fuelwood activities, which account for an additional $19 million or 27 percent. Projects in fossil fuels account for the balance of $18 million or 26%.

I would like to cite some examples of how, in extending technical assistance in renewable energy and energy conservation, A.I.D. helps to increase the U.S. export potential to developing countries and promotes growth of the private sector in these societies.

A.I.D. recognizes the potential of Third World markets for U.S. photovoltaic products because of their suitability for remote, low-power applications in locations not accessible to a central electricity grid. As has been pointed out during these hearings, less developed countries represent the largest market for U.S. photovoltaic manufacturers to develop the skills and experience necessary for development of viable enterprises in this field.

A practical illustration of how the Agency can help American industry to open new foreign markets for energy products is found in our accomplishments during the past three years in evaluating the capability of photovoltaic technology to meet rural electricity needs in the developing world. Since

1979 we have invested $3.4 million in this effort, using as our project manager the NASA/Lewis Research Center in Cleveland, a pioneer in photovoltaic R&D since 1960.

Our initial pilot project with the Lewis Center was the installation of a 1.8 kW photovoltaic unit to power a water pump and small mill for grain grinding in an Upper Volta village. Equipment procurement was by competitive bid from U.S. suppliers. PV modules, later doubled in capacity to 3.6 kW, were bought from the Solarex and Sensortech Corporations, lead acid batteries from the C&D Company, and other equipment from U.S. industrial sources.

NASA's field tests enabled the manufacturers to modify system components to significantly improve their reliability. Outage rates now are not only considerably lower than for utility power in many developing countries, but generally are less than for U.S. central grid power. With increased volume, mechanization and new technological advances, lower prices are expected to make photovoltaics increasingly competitive in remote locations while costs of electricity generated from fossil fuels will continue to rise.

In Tunisia we expect to begin operation this year of a photovoltaic power system integrated with wind and solar heating units in a village of 120 people 80 miles Southwest of Tunis. In this cost-shared project with the Government of Tunisia, the Solar Power Corporation of Woburn, Massachusetts, is installing a 10 to 20 kW system to service domestic and commercial needs in the village. At another remote Tunisian site, two

600-watt systems will power drip irrigation for a greenhouse and orchard. As photovoltaic costs drop, U.S. manufacturers, through such demonstrations, will be positioned to rapidly exploit the market potential in rural parts of the Third World.

At 18 remote sites in developing countries, A.I.D. is cooperating with the Department of Energy and Center for Disease Control of the Department of Health and Human Services to field test photovoltaic-powered refrigerators for the preservation of vaccines. Refrigeration of pharmaceuticals is difficult in rural locations where electricity often is unavailable or unreliable. Power outages and variations damage or shorten the life of refrigerators.

In order to evaluate the medical refrigerators under varying conditions in developing countries, the Lewis Center purchased under bid ten units from the Solar Power Corporation and ten from Solavolt International, a joint subsidiary of Motorola and Shell Oil, with photovoltaic arrays procured from Solarex. As a direct result of these field tests, the Inter-American Bank asked Solarex to consider replication of these systems in Ecuador and Guyana. The Solar Power Corporation has sold a number of medical refrigerators as a result of the project and plans to tap the global market for high-quality medical refrigerators, which it estimates will be 60,000 units within this decade.

A.I.D. has funded photovoltaic-powered electricity supplies for rural health clinics in Ecuador, Guyana, Kenya and Zimbabwe. Scheduled to begin operation this year, each clinic will use its 2 kW of battery-stored power for refrigeration of pharmaceuticals, ionization sterilization, lights for examination and surgery, dental drills, and other medical equipment. Clinics are well-suited to photovoltaic power since they require modest amounts of electricity from a reliable source. Introduction of solar power is expected to lead to marked improvements in the effectiveness of rural health delivery. The three U.S. manufacturers supplying the equipment foresee a sizable market for applications in developing countries.

One of the objectives of these demonstrations is to accelerate the commercialization of photovoltaics and to activate the latent worldwide market by carrying out projects whose costs are shared by A.I.D., host countries and U.S. suppliers. The Lewis Center has calculated that for Third World applications having an annual power demand of 6,000 kWH or less, the cost of a photovoltaic module, even at $7 a peak watt, is in many circumstances less than that of diesel-powered systems. For small, remote power requirements, the NASA researchers found photovoltaics competitive with utility line extensions of ten miles. Since the cost of photovoltaics is expected to decline steadily during this decade, this source of power conceivably could become the least expensive and most reliable for selected decentralized applications in developing countries.

A good illustration of how A.I.D., in carrying out development assistance projects in energy, promotes the export of U.S. goods and services is found in our small hydropower activities. The Agency's efforts focus on identifying the appropriate contribution of decentralized waterpower to the national energy mix of a developing country by means of resouce surveys and site feasibility studies. The National Rural Electric Cooperative Association (NRECA), with A.I.D. funding, arranges for U.S. experts to conduct in-country studies. The frequent use of specialists from U.S. industry and consulting firms makes available to the LDC's outstanding U.S. expertise and provides our private sector with exposure and access to potential markets. Orders for American turbines, generators and control equipment are resulting from these A.I.D.-sponsored activities. For example, NRECA assisted the A.I.D. Mission in Thailand to develop an $8.1 million project involving procurement of U.S. small hydropower equipment for 12 demonstration sites.

Last month NRECA conducted a tour of U.S. manufacturers' facilities for Panamanian engineers who are selecting equipment for small hydropower sites under development in that country with A.I.D. assistance. Following completion of these units, Panama expects to develop 40 additional small waterpower sites with funding from non-U.S. sources. This may produce additional orders for U.S. equipment and technical services.

NRECA recently published and distributed to over 70 developing nations a directory of all U.S. turbine manufacturers, listing equipment specifications. Technical specialists from U.S. manufacturers have participated in each of the three A.I.D.-sponsored regional workshops on small hydropower held in Ecuador, Thailand, and the Ivory Coast. Through these activities, U.S. firms established new relationships with energy planners and engineers from many of the 50 developing countries participating in these meetings.

In the production of equipment for small hydropower installations, the United States is not as competitive as European and Asian manufacturers who have long been active in the Third World. In many cases, their equipment is better adapted to local needs and preferences. For example, because only a limited market was anticipated, only one U.S. manufacturer currently makes the cross-flow turbine. However, this device is extremely popular in developing countries because of its simple design, versatility and low maintenance requirements.

Several U.S. manufacturers of small hydropower equipment have indicated to A.I.D. that they wish to identify ways in which they can lend support to U.S. technical assistance programs while pursuing their own commercial objectives. At A.I.D.'s request, NRECA is organizing a two-day workshop in Washington, June 28-29, to which more than 20 U.S. private sector firms will be invited to discuss this issue with a number of engineers, planners and energy economists who have participated in developing country projects and with officials of A.I.D. and the Trade and Development program. One aim is to identify innovative ways in which U.S. enterprise can improve its competitive position abroad and, conversely, to explore how U.S. industry can contribute to strengthening our development assistance activities.

Bioenergy is another renewable energy field in which A.I.D. is active. A significant activity is a proposed Philippines project where three approaches will be adopted for conversion of wood to energy. Each will serve to promote private sector initiatives. Within a year, a U.S. manufacturer will receive a contract to supply three 5 MW wood-fired boilers with electric generators.

Since the strategy of our wood energy project involves support to U.S. manufacturers, U.S. industry will have an opportunity to demonstrate the quality and competitiveness of its boilers and electric generators in a Philippines market that alone is predicted to reach a level in excess of 100 units within eight years. At an estimated installed cost of $4 million per boiler-generator unit, this will add up to a market of $400 million.

A second component of the Philippines project involves initial purchase of charcoal-burning gasifiers. Producer gas generated from these units, which cost about $2,500 each, is expected to achieve a 70 percent reduction in diesel fuel consumed for irrigated pumping. A.I.D. intends to finance the procurement of 1,060 such gasifiers from U.S. manufacturers within the next three years at an estimated total cost of $2.65 million. The overall market will be substantially larger. We believe Philippines manufacturers, many in joint ventures with U.S. firms, will be attracted to produce these gasifiers.

The third component of the project will be derived from the increased demand for charcoal to fuel the gasifiers. Charcoal will be supplied to a large degree from growing numbers of farmers who will buy more efficient charcoal kilns. The demand for kilns is expected to be met by small and medium-scale Philippines manufacturers. Similar bioenergy projects designed to tap indigenous supplies of wood and charcoal to meet energy needs in both the traditional and modern sectors are under development with A.I.D. assistance in Indonesia, India, the Dominican Republic and Honduras among others.

We plan to sponsor a workshop with U.S. industry probably early this fall to examine developing country markets for bioenergy technology and the potential for industrial services and American products in this field.

The Agency has found more limited opportunities to further the commercialization of renewable energy technologies in fields such as wind, geothermal and solar thermal. Several years ago A.I.D. invested upwards of $5 million in underwriting initial geological and geophysical surveys of the geothermal potential in the Philippines. Data produced from these studies prompted the Union Oil Company of California to invest substantially in geothermal power production with long-term contracts to supply steam for power generation to the National Electricity System. With a projected expansion to a 900 MW capacity, the Philippines would become the world's second largest producer of geothermal-generated power, surpassed only by the United States at 1300 MW.

This month the A.I.D. Africa Bureau Regional Office in Nairobi is co-sponsoring, with the United Nations, a conference on geothermal development attended by the countries of Eastern and Southern Africa located along the geothermally active Rift Valley. The Union Oil Company with A.I.D. assistance is sending a senior representative to the conference who will present to the African participants the story of the successful development of geothermal power in the Philippines with U.S. private sector participation. Hopefully, this will encourage African countries to consider the substantial potential of geothermal energy and the private sector as an alternative source of capital and technical assistance for geothermal development.

A.I.D. is providing other technical experts to participate in the conference. They will describe to the African participants the successful development of the binary-cycle geothermal generating plant that was built and tested recently in California. The technical advance of binary-cycle systems could increase the economics of power generation from lower temperature geothermal sources, thereby expanding the economic use of this renewable energy source.

Volunteers in Technical Assistance (VITA), a U.S. organization whose work in developing and applying low-cost energy technologies is supported by A.I.D., procures U.S. equipment for its projects. As an example, on Roatan Island off Honduras, VITA has installed a Nebraska-manufacturered "Dempster Windpump" to supply potable water through a simple piping system to two dozen or so families in the small island community. Anemometry equipment from two U.S. manufacturers is used in instrumentation to test the wind regime for possible replication of the system at three additional sites. In Trinidad, VITA is testing a low-cost solar pump developed at Cornell University which, if proved effective, may be licensed for production by a U.S. firm. VITA has scheduled a conference next month of a selected group from its roster of several thousand U.S. volunteer scientists and engineers to consider the potential for U.S. commercial manufacture of a wide variety of appropriate technologies it has helped to develop and field test, including a number in the renewable energy field.

Included in resolutions adopted at last year's UN Conference on New and Renewable Sources of Energy was one proposal by the United States that a major share of financing for energy investment in developing countries must come from the private sector. With this in mind, A.I.D. is joining the World Bank, the United Nations Development Program and other UN organizations in funding workshops in New York, Manila, Kingston and Nairobi during September and October of this year which will seek to stimulate new initiatives in renewable energy development by the U.S. and Third World private sectors. The International Institute for Environment and Development, which is conducting the program, has aroused considerable interest among industry representatives, bankers and donor agencies in the workshops. Case studies illustrating innovative successful business ventures involving renewable energy technologies will be presented and policy actions required to facilitate private enterprise by governments in both developed and developing countries will be considered.

A.I.D. is undertaking new activities in energy conservation on grounds that for the next five to ten years, conservation offers many LDCs the only solution to making more energy available for industrial development as well as current user demands with limited petroleum imports. In a number of Third World countries major energy savings can be realized in the industrial sector, which often is dominated by a few energy-intensive facilities such as cement and chemical fertilizer plants, oil refineries, pulp and paper manufacturers and primary metal producers. Highly efficient energy conversion technologies can be retrofitted in old plants and specified in plans for new manufacturing and processing facilities. Compared with virtually every other option for increasing supplies of energy, conservation for most LDCs enjoys the advantage of far shorter lead times, lower cost and faster payback.

Recent A.I.D.-funded case studies in Haiti and Sri Lanka, countries with among the world's lowest per capita incomes, revealed that considerable conservation potential is available in industry, transport, and large commercial buildings. In Haiti, the combined production of the cement plant, electric power stations and its bauxite industry accounts for 80 percent of imported fuel. Energy savings in industry, including the cement plant, could significantly reduce petroleum imports, which now amounts to about $4 million per month. In Sri Lanka, the World Bank energy assessment concluded that for the next five years only conservation could alleviate current energy supply shortages.

As oil-importing developing countries undertake energy audits of industrial plants, buildings, transportation systems and other uses, demand will increase for new equipment which offers more efficient conversion of existing energy supplies. The audits will be performed by U.S. contractors and consultants with support from A.I.D. A.I.D. assistance in energy conservation activities, as well as its established projects in energy planning and training, undoubtedly will lead to procurement of new equipment from U.S. industry. As an example of this activity, the Jamaica Ministry of Mining and Industry with A.I.D. help is undertaking a $2.7 million energy audit of industry, commercial buildings, hotels, hospitals and transportation facilities. Major hotels and hospitals will be retrofitted with alternative energy sources, such as solar water heaters and cooling systems. In Southeast Asia the rapidly growing demand for air conditioning has prompted A.I.D. and ASEAN, a regional organization of five countries, to initiate an assessment of energy efficiency in commercial building. A significant market of as yet undetermined size exists for retrofitting energy production and utilization systems in developing countries. The U.S. private sector should be prepared to take advantage of this opportunity as it develops.

In his address to the World Affairs Council of Philadelphia last October, President Reagan observed that since addressing energy problems of developing countries is vital to their sustained economic growth, "The United States will emphasize funding for energy-related activities in the years ahead, especially for private efforts and the mobilization of developing country resources." He said that, "Our energy bilateral aid program must stress technical assistance rather than resource transfers."

Section 601 of the Foreign Assistance Act declares that it is the policy of the United States "to encourage the efforts of other countries to increase the flow of international trade, to foster private initiative and competition, and to encourage the contribution of United States enterprise toward economic strength of less developed friendly countries, through private trade and investment abroad . . . ."

To help overcome barriers to effective donor assistance, A.I.D. supports activities which encourage government policy reform, improve institutional capacity, upgrade human resources, develop and spread new technologies, and generally stimulate the private sector. Our private sector thrust is intended to increase the benefits of development through economic growth, employment, and income generation. Responding to potentially profitable opportunities, private enterprises in developing countries produce jobs, foreign exchange and a base of managerial and technical skills. All these are essential to meet the needs of the poor majority. In its new emphasis upon the role of the private sector in development assistance, one of A.I.D.'s underlying goals is to create an environment of economic opportunity conducive to the advancement of indigenous business enterprise. The bulk of funding for A.I.D. private sector activities is in our bilateral country programs through the normal programming process. Our field missions identify and justify private sector projects in the same way as for activities in other sectors.

The Bureau for Private Enterprise was established last year to function as the catalyst to advance the private sector initiative throughout the Agency in a cost-effective and flexible manner. This initiative grew out of the conviction, based upon remarkable economic advancement in Third World countries such as Taiwan, South Korea, Brazil and Singapore among others, that a vigorous private sector can serve as the engine for growth in developing countries as it has done in the United States and other industrialized nations.

In an effort to test new and cost-effective methods of facilitating projects that will strengthen indigenous private sectors in Third World countries, the Bureau adopted several basic operating principles. It seeks ways to stretch limited A.I.D. funds by attracting the resources of others -- private sectors in the U.S. and developing countries, commercial banks and multilateral lending institutions. A primary area of concentration is inspiring and facilitating joint ventures between American and indigenous LDC firms. Such joint ventures would transfer technology and skills and provide financial support to developing countries while opening up opportunities for U.S. companies.

In summary, through its technical assistance programs in energy which are directed toward addressing the development needs of the LDC's, A.I.D. seeks to advance U.S. private sector interests in a broad and diverse number of ways:

-- Involving U.S. industry in A.I.D. development assistance activities. This makes use of U.S. industrial know-how to assist the LDCs solve their energy problems, and at the same time provides our industry opportunities to become familiar with and explore developing country markets. Hardware and technical consultants for A.I.D.-funded projects are procured from U.S. suppliers.

-- Workshops and conferences funded by A.I.D. provide new contacts between U.S. industry and developing country energy personnel.

-- A.I.D. projects field-test U.S. energy products in order that they can be adapted and modified for Third World applications.

-- Developing country markets for renewable energy and energy conservation technologies are identified in the course of the Agency's technical assistance programs.

-- A.I.D.-supported conservation surveys and energy audits point up the need for new machinery and equipment. Where possible, U.S. products and capabilities are demonstrated.

-- A.I.D. training programs in renewable energy technologies serve to establish contacts between the LDC participants, who are often key government agency officials, and U.S. industrial representatives.

-- Directories, catalogues and specifications of American-made equipment are circulated to developing countries by A.I.D. and its contractors.

We believe that renewable energy technologies will play an increasing role in developing countries, over time. In this area, as well as in conservation, we are working closely with our industry. A.I.D.'s activities offer significant encouragement and support to our industry -- accessing the developing country market potential.

Mr. GORE. Thank you very much. A very impressive, substantial statement.

Mr. Hardy, if you would go next.

Mr. HARDY. Thank you, Mr. Chairman.

I appreciate the opportunity to discuss the trade and development program and its role in promoting exports of U.S. solar technologies abroad before the Subcommittee on Energy Development and Applications and Investigations and Oversight.

I would like first to provide you with a brief overview of the TDP, and then discuss our activities in the solar area.

The Trade and Development program was established in July 1980 as a separate component agency of the International Development Cooperation Agency. It was delegated authority under two sections of the Foreign Assistance Act—section 607(A) and section 661.

Under section 607(a), TDP is the authorizing and coordinating agency for the provision of U.S. technical expertise to foreign governments.

The bulk of TDP's activities, however, occur under the authority of section 661, by which TDP grant finances feasibility studies and other project planning services for major development projects in the Third World. Under these authorities, TDP has three complementary objectives.

First, to foster development in the Third World. Contrary to U.S. bilateral concessional assistance programs, which provide project financing, trade and development program is involved only with planning services. As a consequence, the foreign countries which are most interested in TDP's resources are those which have foreign exchange or have access to financing from the international financial institutions.

Accordingly, they seek technology and project planning assistance. The trade and development program can provide them or assist them in acquiring U.S. technology and utilizing U.S. firms in their technical assistance in the project planning area.

The second objective is to facilitate the use of U.S. goods and services in priority development projects. The trade and development program accomplishes this objective by requiring as a condition to its grant financing that the country utilize a U.S. firm to provide the technical assistance. Accordingly, U.S. firms get in on the ground floor of projects and are placed in the best position for downstream follow-on work and project implementation.

Second, TDP financing improves the competitive position of U.S. firms which are seeking contracts from foreign governments when they are competing with firms of other industrialized nations which use concessional aid and export credits to secure major implementation contracts for their export industries.

Third, perhaps the one most relevant today, is that other TDP activities, such as symposia, introduce U.S. technology and goods to countries and to their decisionmakers who are not aware of U.S. capabilities in the sector. The third objective is to facilitate access to national resources of the United States. While the trade and development program has a specific mandate in this area, this is a new focus of this administration.

Before I address the solar energy area, let me first discuss the budget.

In fiscal year 1982, the trade and development programs total budget was $6.907 million, of which $5 million is devoted to program activity. The administration's requests for fiscal year 1983 is $10.5 million, of which $8 million is to be allocated to the program budget.

If I can address our activities in the solar area, since 1980 TDP has been involved in four solar energy projects: A solar energy applications project in Brazil which was a prefeasibility study including joint workshops in Brazil, and a technical orientation visit by Brazilian decisionmakers to the United States to identify project opportunities for solar industrial-process heat and agricultural applications in the four southern states of Brazil.

In this coming year we are planning a follow-on project which would be to encourage the establishment of joint ventures in solar energy areas which seem the most advanced, which the Brazilians are most interested in.

Second is a renewable energy technology workshop undertaken in Jamaica in 1981 in cooperation with the Overseas Private Investment Corporation and Department of Energy to expose officials throughout the Caribbean to the state-of-art U.S. solar technology.

It was projected that at that conference over $300,000 worth of solar equipment was sold, and it was projected that sales of equipment flowing from that workshop would amount to over $5 million in the next year or two.

The third activity in the solar area was the solar energy technology orientation visit by a Qatari official in 1981 to view U.S. solar energy projects and to discuss commercial solar energy applications with U.S. experts.

The fourth project was a 1982 renewable energy definitional mission, which is designed as a follow-on to the activities of AID in Tunisia in the solar area. This was a planning trip to determine Tunisian interest in the symposium which would explore how U.S. solar technology would be appropriate in specific Tunisian applications.

Some potential solar projects which TDP is now considering include a solar pond brine mining application project in Botswana, a follow-on project I referred to in Brazil, and a solar tea-leaf-drying project in Sri Lanka.

In conclusion, Mr. Chairman, the trade and development program has sought to encourage the use of U.S. solar technology and equipment overseas. Because the U.S. Government and the private sector have devoted large sums of money to develop new technologies in the solar area, the United States is highly competitive in such equipment. As the solar field continues to develop, increasing the interest of the developing countries in this area, TDP would like to devote greater attention and resources to supporting solar projects.

Thank you.

[The prepared statement of Mr. Hardy follows:]

TESTIMONY OF

JOHN HARDY, JR.

DEPUTY DIRECTOR

U.S. TRADE AND DEVELOPMENT PROGRAM

BEFORE

THE SUBCOMMITTEE ON OVERSIGHT AND INVESTIGATIONS AND

ENERGY DEVELOPMENT AND APPLICATIONS

OF THE

COMMITTEE FOR SCIENCE AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

JUNE 21, 1982

Mr. Chairman and Members of this Subcommittee, I appreciate this opportunity to appear before you today to discuss activities of the U.S. Trade and Development Program (TDP) in the solar energy area.

I would like first to provide you today with a brief overview of TDP, as well as to provide you with a brief summary of our endeavors in solar energy since 1980.

TDP

The Trade and Development Progam was established on July 1, 1980 as a component of the International Development Cooperation Agency with three complementary objectives: to foster development in the Third World, to promote U.S. trade by stimulating the use of U.S. technology, goods and services in major development projects and to facilitate access to natural resources of interest to the United States. TDP project planning services are carried out by U.S. private firms and government agencies in a wide range of development sectors including energy and food production, infrastructure development and technical training.

TDP also serves as the coordinating and authorizing agency for the provision of government-to-government technical assistance on a fully reimbursable basis, involving many U.S. government agencies such as the Army Corps of Engineers and the Department of the Interior's Water and Power Resources Services.

For FY 1982, the Congress authorized and appropriated a $6.907 million budget for TDP. For FY 1983, the Administration is seeking $10.5 million for TDP, of which $8 million will comprise TDP's program budget.

The countries requesting TDP services often have substantial foreign exchange or access to international public and private lending sources to finance their development. They turn to the industrialized countries for the technology they need and seek planning assistance to help them implement major projects. TDP provides them with access to U.S. technology and provides planning assistance for major projects.

TDP constitutes an inextricable part of the U.S. development assistance program and U.S. trade policy and its developmental impact on middle income countries makes it a valuable instrument of U.S. foreign economic policy. Its efforts are focused on the countries in the developing world of particular economic importance to the United States. TDP's presence in these countries is important politically for the transitional role the Program can play during the period when the country is moving away from concessional assistance; TDP's presence during this transitional phase reflects an on-going U.S. interest in the welfare of these countries.

The specific planning services which we, as well as our export competitors, provide include:

- pre-feasibility and feasibility studies, as a result of which the appropriate technology for a development project is specified;
- workshops and seminars which help stimulate and identify development projects in a sector of high priority to the host country;
- technical orientation missions, in which key host country decision-makers visit U.S. firms having equipment and expertise in a sector of high development priority to the host country; and
- provision of short term technical assistance to help a host country develop projects of high priority.

Before TDP will become involved in a project, the project must comply with the following basic criteria:

- TDP projects must rank high on the list of development priorities of the host country and be of special importance in that country's development plan.
- TDP planning services must have a direct relationship to the promotion of project implementation; specifically, TDP funds are only used when it appears that a U.S. firm will not be able to provide a planning service without TDP involvement.

-- Projects must involve:

(a) an opportunity for substantial sales of U.S. goods or services through direct contracts with U.S. suppliers, and/or

(b) the enhancement of U.S. access to natural resources of interest to the United States.

-- Countries eligible for TDP planning services must be:

(a) "friendly countries" and

(b) developing countries which have allocated substantial resources for procurement of foreign goods and services for major development projects.

-- There must be assurance that funding for project implementation will be available from host country foreign exchange earnings or external sources other than U.S. aid programs. Additionally, follow-on procurement must be open to U.S. firms or agencies.

TDP Activities in Renewable Energy Projects

Since 1980, TDP has been involved in four solar energy projects:

-- A Solar Energy Applications project in Brazil which was a pre-feasibility study including joint workshops in Brazil and technical orientation visits to the U.S. to identify project opportunities for solar industrial process heat and agriculture applications in the four southern states of Brazil;

-- A Renewable Energy technology workshop in Jamaica in 1981 to expose officials to state-of-the-art U.S. alternative and renewable energy technologies;

-- A Solar Energy Technology orientation visit for a Qatari official in 1981 to view U.S. solar energy projects and to discuss commercial solar energy applications with U.S. experts;

-- And a 1982 Renewable Energy Definitional Mission which was a preliminary planning trip to determine Tunisian interest in a symposium which would explore how U.S. solar technology would be appropriate to specific Tunisian applications.

Some potential solar projects which TDP is now considering include a solar pond brine mining application project in Botswana, a follow-on project to the Brazil study which will attempt to establish U.S. solar firms in joint ventures in Brazil to produce energy efficient solar devices such as heat pumps, and a solar tea leaf drying project in Sri Lanka.

Because TDP does not provide project financing, it must follow the development priorities of the countries in which it finances activities, since it is their governments that will decide in which projects to allocate their funds.

Developing nations desperately need to move away from oil-based energy sources to other sources of energy. Accordingly, TDP, following the lead of these countries, is heavily involved in energy projects. The countries requesting TDP services have shown the most interest to date in alternate energy generation systems, particularly by converting their oil-fired power generation systems to coal and by development of their hydropower resources. Based on their requests for TDP planning services, they have been less interested in the solar energy area. In fact, we recently suspended plans for a solar energy technical symposium in Tunisia because of lack of interest on the part of the Government.

Moreover, U.S. firms have shown less interest in TDP activities in the solar area than they have in other energy sectors. The tea-leaf drying project in Sri Lanka is the first proposal to TDP by an established firm interested in an investment project in the Third World. This compares with almost daily proposals by U.S. firms for TDP activities in other energy projects.

In conclusion, Mr. Chairman, TDP has sought to encourage the use of U.S. solar technology and equipment overseas but has been constrained by the relative lack of interest on the part of the Governments for which we finance planning services. Because the U.S. Government and the private sector have devoted large sums of money to develop new technologies in the solar area, the U.S. is highly competitive in such equipment. As the solar field continues to develop, increasing the interest of the developing countries in this area, TDP would like to devote greater attention and resources to supporting solar projects.

Mr. GORE. Thank you very much.

Dr. Gerald T. West.

Mr. WEST. I also would like to thank you, Mr. Chairman, for the opportunity of testifying before the committee.

I would like to make just two introductory points then talk briefly about our charter, and then go into a little detail about our activity in the energy area.

The first introductory comment I would like to make is to note that OPIC is not in the export promotion business per se. Rather, our mandate as a self-sustaining public corporation is to contribute to the economic and social development of less-developed friendly countries and areas by insuring U.S. private investments against certain perceived political risks and participating in the financing of private projects through direct loans and loan guarantees.

In addition, we also offer some preinvestment assistance, such as the funding of feasibility studies, the awarding of incentive grants. We also conduct investment missions to various countries to acquaint businessmen, especially U.S. small businessmen, with investment opportunities in the developing world.

As our name implies, we accomplish our development and other mandates through facilitating foreign direct investment. There certainly are important connections between investment and trade, and we are required by statute to endeavor to support those developmental projects having positive trade benefits for the United States, and, I might add, to withhold support from investment projects that are likely to harm U.S. trade or the U.S. economy. But the bottom line remains that we are not an export promotion agency.

The second introductory point is that our programs and activities are oriented toward assisting U.S. investment in the private sectors of developing countries rather than projects where the host government plays a predominant role. In short, we are not in the business of providing government-to-government assistance.

Let me turn to and briefly summarize our major programs for those in the audience who may not be fully familiar with them.

By far the largest program that we operate is our political risk insurance program, which dates back to the Marshall plan days. We insure eligible U.S. investors against host country risks of currency inconvertibility, expropriation, war, revolution, and insurrection, in some 97 developing countries and overseas territories. Our insurance program also includes coverage of contractors' and exporters', bid performance, and advance payment guarantees.

Second, we also have a finance program which includes direct loans from our direct investment fund and all risk loan guaranties. Our direct loans are limited by statute to U.S. small businesses, while our loan guaranty program is limited to U.S. financial institutions.

Despite difficult world economic conditions in the last fiscal year, it was a record year for us at OPIC in terms of our activities. Our insurance volume increased to $1.48 billion of coverage, the highest level in our 11-year history, representing some 95 projects in 33 countries. Our net income for the year reached an all-time record of some $76 million, enabling us to continue as a self-sustaining agency at no cost to the taxpayer.

Loan and loan guarantee commitments were issued for about $101 million for 20 projects, the largest number of financial commitments for us in any single year. We finished the fiscal year with combined insurance and loan guarantee reserves of over $660 million. I might add, fiscal year 1982 promises to be even better than last year .

The third major set of program activities, which are quite modest in scope compared to our insurance and finance activities, includes a variety of investment encouragement activities. These include investment missions in which we lead a group of investors, at their expense, to a particular country to investigate investment opportunities.

Second, we support feasibility studies, which we have found are often necessary before investment projects can be undertaken in developing countries. In this program we will share with the prospective investor the costs of conducting a study of a particular investment opportunity in a developing country. The overwhelming majority of these feasibility studies support funding to U.S. small business.

The third form of investment encouragement we utilize is our training grants programs where, through intermediary institutions primarily, we encourage the development of technical and management skills that we find are often necessary for successful business operations in the Third World.

Since 1978, we have sought at OPIC through our programs to increase the opportunities for small businessmen to participate in the international development process. We have found this is an inherently difficult task since small businesses face special problems related to their lack of experience in identifying and setting up overseas investments—as well as a general reluctance on the part of commercial lenders to provide capital, either in the amounts or on the terms that are required.

To address these problems, we have developed specific programs designed to help identify investment opportunities and to aid small business in implementing their investment overseas. These efforts, I am proud to report, have increased small business participation in both the insurance and finance programs. In all 3 fiscal years since 1978, OPIC has met the congressional target of involving small business in at least 30 percent of the projects that we insure, guarantee, reinsure, or finance.

Now, the broad energy area has been of concern to us at OPIC since 1977 when we initiated a program designed to assist non-OPEC developing countries in discovering and producing indigenous hydrocarbon energy resources. This program has resulted in the assistance of some 10 oil and gas exploration development and projects in 7 developing countries. These projects have involved over a billion dollars in total investment.

Needless to say, these projects do more than provide direct benefits to the host countries. By increasing supplies of energy on a worldwide basis, they will have a moderating effect on oil prices worldwide.

In my written testimony, I have reviewed some specific OPIC-assisted projects and activities in support of the objective of marketing U.S. conservation and renewable energy technologies abroad. OPIC participated very extensively in the first large-scale commercial geothermal energy plant constructed outside of the United States in the Philippines that my colleague from AID referred to; I will not go into any details on that particular project.

At the opposite end of the spectrum, in terms of a small investment encouragement activity, as John Hardy mentioned, OPIC participated in the sponsoring of the Caribbean Trade Promotion Symposium and Exhibit on Renewal Energy held at Kingston, Jamaica this past summer. By our statistics, I might add, he underestimated in his statement the results of that program in terms of U.S. energy sales that resulted from it. We think that the Kingston Symposium in particular epitomized what can be done in terms of promoting the mobilization and facilitation of U.S. private capital and skills in the economic and social development of countries such as Jamaica, and directly complement our development assistance goals as a government.

Certainly on OPIC's part, we are more than willing to consider such future opportunities for assistance when they occur. We are very cognizant of the special needs of U.S. small business and high technology firms in the overseas area.

In my testimony I review a rather unique training grant that we have provided to the Fund for Multinational Management Education, a nonprofit organization, to establish a self-sustaining technology program in the five ASEAN countries. This program will involve the training of between 40 and 50 ASEAN and private sector executives each year in the skills necessary to plan, purchase, install, and manage U.S. technology for their companies. The continuity of U.S. participation will be insured by the fund's ongoing role in providing U.S faculty for the courses, as well as serving as a liaison between the U.S. and ASEAN businesses community. We view this program as being of special interest and merit to U.S. small businesses that have difficulty at times selling their wares in such dynamic markets as the ASEAN countries.

I would like to turn briefly to the subcommittee's interest in our plans for the future. To a large extent our future role will depend on commercial opportunities in the Third World arising so that U.S. suppliers of solar and conservation technologies can take advantage of them.

From the perspective of our insurance activity, the outlook is very promising. We have currently eight applications that are pending for the development and application of renewable energy technologies. They vary from gasohol projects and geothermal projects to wood and charcoal facilities. The total estimated value of these investments is about $366 million.

These investments are still in the planning stages. OPIC has not made any financial commitments to these projects. And we have found in many instances that registered projects such as these may not go forward with any great certainty. Nonetheless, we are quite hopeful that they will.

In planning for our investment missions, we consult very closely with host country governments regarding the economic sectors they have identified as having a high priority and investment opportunities that they think are feasible. And I am proud to say that a number of these involve the solar energy or renewable energy areas.

For example, in the case of our forthcoming October mission to the Eastern Caribbean, we have been asked to recruit investors with an interest in solar driers, heaters, coolers, biogas, wood cookstove, and windmill projects.

The Government of Pakistan, where we are planning an investment mission in December, has expressed an interest in manufacturing solar-powered water pumps for irrigation. Needless to say, our marketing department is currently seeking to recruit U.S. executives from those sectors to participate in those investment missions.

At OPIC, we hope and expect that our enhanced efforts to promote investments in the developing countries will stimulate and facilitate increased investment in the international production and sale of conservation and renewable energy technologies.

We share your concern about the need for enhanced U.S. export of these technologies, both for the sake of development and to accelerate their application to our own energy needs here at home. We see no fundamental problems at OPIC in providing U.S. businessmen with insurance or other support within the limits of our statute, our budget and our manpower.

In general, we believe that the alternative energy area is inherently developmental both in macroeconomic terms and in microsocial and economic terms. We also, needless to say, see direct trade benefits for the United States in promoting the sale of these technologies, and we are aware of the stiff competition faced by U.S.

companies in these sectors. We certainly look forward to assisting U.S. firms in their overseas activities.

Thank you, Mr. Chairman.

[The prepared statement of Mr. West follows:]

PREPARED STATEMENT OF GERALD T. WEST
VICE PRESIDENT, OFFICE OF DEVELOPMENT
OVERSEAS PRIVATE INVESTMENT CORPORATION

PRESENTED BEFORE THE SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS

and the

SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT OF THE COMMITTEE ON SCIENCE AND TECHNOLOGY

UNITED STATES HOUSE OF REPRESENTATIVES

June 21, 1982

Mr. Chairman, members of the Subcommittees on Energy Development and Applications and Investigations and Oversight:

Thank you for the opportunity to testify on the role of the Overseas Private Investment Corporation in promoting the sale of U.S. solar and conservation technologies abroad. Let me stress a few things about OPIC at the outset of my testimony. We are not in the export promotion business, *per se*; rather our mandate, as a self-sustaining public corporation, is to contribute to the economic and social development of less developed friendly countries and areas by insuring U.S. private investments against certain perceived political risks and by participating in the financing of private projects through direct loans and loan guaranties. In addition, OPIC also offers pre-investment assistance, such as the funding of feasibility surveys and the awarding of incentive grants, and conducts investment missions to various countries.

As our name implies, we accomplish our development and other mandates through facilitating foreign direct investments. There are, most certainly, important connections between investment and trade and OPIC is required by statute to endeavor to support those developmental projects having positive trade benefits for the United States. We are also required to withhold support from investment projects that are subject to host country performance requirements which would reduce substantially the positive trade benefits likely to accrue to the United States from a given investment.

The economic benefits to the United States of OPIC's activities has been very positive. OPIC-assisted investments in fiscal year 1981 alone are expected to generate 2.4 billion dollars in total U.S. exports during their first five years of operation. Over 38,000 man-years of incremental U.S. employment will also be created during this same period. This is twice the volume of estimated U.S. procurement and jobs we achieved in FY 1980. Note that the investments themselves are the vehicle for increasing U.S. exports; OPIC does not promote exports directly.

The second point I wish to stress is that OPIC's programs and activities are oriented towards assisting U.S. investment in the private sectors of developing countries rather than projects where the host government plays a predominant role. We are not in the business of government-to-government assistance.

It is partly for this reason that I must report to you that OPIC has done very little in the energy sectors that are of particular interest to this Committee. We simply have not had the opportunity to assist U.S. firms in the alternative energy field, as few such investment projects have been submitted to us. However, I wish to assure you that we are willing and able to do so. Nothing in our statute or management's policy would prevent us from assisting conservation and renewable energy projects, so long as the investors are sound, their projects are developmental and they meet other Congressionally-mandated criteria with respect to U.S. production, trade and employment.

Allow me to summarize briefly OPIC's three major programs for those present who may not be familiar with them. By far the largest program is our political risk insurance program. OPIC insures eligible U.S. investors against host country risks of currency inconvertibility, expropriation, and war, revolution, and insurrection in 97 developing countries and overseas territories. Our insurance program includes coverage of contractors' and exporters' bid, performance and advance payment guaranties.

Our finance programs include direct loans from our small Direct Investment Fund and all-risk loan guaranties. Our direct loans are limited by statute to U.S. small businesses, while our loan guaranty program is limited to U.S. financial institutions.

Despite difficult world economic conditions, fiscal year 1981 was a record year for OPIC. OPIC's insurance volume increased to $1.48 billion of coverage -- the highest level in its 11 year history -- representing 95 projects in 33 countries. Net income for the year reached an all-time record of $76.2 million, thereby enabling OPIC to continue as a self-sustaining agency at no cost to the taxpayer. Loan and guaranty commitments were issued for $101.3 million for 20 projects -- the largest number of financial commitments for any single year. OPIC finished the fiscal year with combined insurance and loan guaranty reserves of over $664 million. Fiscal year 1982 promises to be even better.

Our third major set of programs, which are quite modest in comparison with our primary insurance and finance activities, include a number of Investment Encouragement activities. These include:

- Investment Missions - in which OPIC leads a group of investors (at their own expense) to a particular country to explore particular investment opportunities. (For example, last December we led a mission to Haiti in which the participants included two Florida firms with an interest in developing a biomass project resulting in the production of methanol and fuelwood. Interest in that project is continuing).

- Feasibility Studies - are often necessary before investment projects can be undertaken in unfamiliar overseas locations. On a very selective basis, OPIC will share with a prospective investor the cost of conducting a feasibility study of a particular investment opportunity in a developing country.

Another form of investment encouragement is our Training Grants program. OPIC assists through intermediary organizations the development of the technical and management skills necessary for successful business operations. We have utilized these promotional programs, which I must emphasize are extremely modest in terms of budgetary resources and manpower, primarily to assist small businesses and cooperatives.

Since 1978, OPIC has sought, through its programs, to increase opportunities for small business to participate in the international development process. This is an inherently difficult task since small firms face special problems related to their lack of experience in identifying and setting up overseas investments as well as a general reluctance on the part of commercial lenders to provide capital in the amounts or on the terms required. To address these special problems, OPIC has developed specific programs designed to help identify opportunities and to aid in implementing small business investments. For several years, under the export and investment seminar program sponsored by OPIC in cooperation with the Export-Import Bank, the U.S. Departments of Commerce and Agriculture, and the Small Business Administration, officers of the five agencies provided information on available services and opportunities to over 12,000 small business executives in over 75 cities around the country. In addition, OPIC has organized numerous small business seminars devoted exclusively to overseas investment. In addition, our direct loan program is reserved exclusively for small business.

These efforts have resulted, we are pleased to report, in increased small business participation in both the insurance and finance programs. In all three fiscal years since 1978, OPIC has met the Congressional target of involving small business in at least 30 percent of projects insured, guaranteed or reinsured.

The broad energy area has been of concern to OPIC since 1977 when we initiated a program designed to assist non-OPEC developing countries in discovering and producing indigenous hydrocarbon energy resources. This program has resulted in assistance for ten oil and gas exploration, development and production projects in seven non-OPEC developing countries. These projects have involved over $1 billion in total investments. Outside of the oil and gas sectors, OPIC's energy portfolio has included dry cell battery projects in Israel, Nigeria and Sudan, a landmark geothermal project in the Philippines, an industrial conservation project in Brazil, rural electrification in Syria and contractors' insurance for hydroelectric projects in numerous countries. These projects will do more than provide direct benefits to the host countries. By increasing supplies of energy, they will have a moderating effect on oil prices worldwide.

Let me now review some specific OPIC-assisted projects and activities in support of the objective of marketing U.S. conservation and renewable energy technologies abroad.

One project in particular stands out in the insurance area. OPIC is particularly proud of its role in assisting the first large-scale commercial geothermal energy plant constructed outside of the United States. This project involved a contract by Philippine Geothermal, Inc. (PGI), a wholly-owned subsidiary of Union Oil Company, with the Philippine National Power Company (NPC) to supply geothermal steam for generating electrical power on the island of Luzon.

Although tapping the earth's heat as an energy resource had previously been used in small-scale projects in the U.S., Ireland, New Zealand and Italy, the large-scale use of natural steam as proposed in this project constituted a new application of geothermal technology. The contractor, Union Oil, had developed the only natural geothermal steam field for electrical power generation in the United States -- the "Geysers" -- located north of San Francisco and having a 500,000 kilowatt generating capacity.

From the perspective of the Philippines, the project was viewed as an attractive alternative to increasing reliance on expensive and insecure foreign oil. Due to a growing demand for electrical power on the island of Luzon and a lack of hydroelectric potential, the Philippine government decided to exploit known deposits of steam located in the southern penninsula of the island. The geothermal project promised not only to provide a secure and relatively inexpensive source of energy for local industry but also to create jobs for local residents and stimulate the economy of an otherwise depressed area.

Lastly, for OPIC the Philippine geothermal project was another sort of breakthrough; it was the first time we insured an investment in a form other than contributions of equity or loan capital to a foreign enterprise. PGI sought OPIC insurance to assure the recovery of its costs in developing the energy resource against the risk of inconvertibility due to a foreign exchange shortage in the Philippines, the risk that a future government might repudiate the contractual obligation to reimburse and pay PGI for services and fuel, and the risks of war, revolution and insurrection. On the basis of its potential contribution to the development of the Philippines, OPIC agreed to insure the project and took the occasion to initiate its coverage of technical service contracts.

By 1979, two production sites had been established and geothermally-produced electricity was supplying portions of the island. Now nearly in full operation, the project makes the Philippines second only to the United States in geothermal energy production.

At the opposite end of the scale in terms of magnitude, OPIC, as part of our investment encouragement program, sponsored and participated in the Caribbean Trade Promotion Symposium and Exhibition on Renewable Energy held at Kingston, Jamaica from July 28-30, 1981.

OPIC's particular reasons for participating in the symposium are indicative of the kind of role OPIC can be expected to play in the promotion of U.S. renewable energy technology. We try to make the most of our limited resources in investment promotion.

OPIC viewed the Kingston symposium as a worthwhile opportunity to realize its primary mission of mobilizing and facilitating the participation of U.S. private capital and skills in the economic and social development of less-developed friendly countries and areas, thereby complementing the development assistance objectives of the United States. Recognizing that the Caribbean area is a high foreign policy priority of the Administration, and that renewable energy is a matter of great interest in the Caribbean Basin, which has been hard hit by the costs of its petroleum imports, OPIC viewed the symposium as an opportunity for enhanced cooperation between the United States and the region. OPIC also hoped that the symposium would stimulate increased private sector interest in the Caribbean and that the high level of participation on the Caribbean side would lead to a recognition of the need to improve the investment climate of certain countries where private investment had not been fully encouraged in the past.

The symposium itself and its immediate accomplishments were encouraging. Twenty-seven United States companies provided exhibits of renewable energy technologies ranging from solar collectors and heat and light reflecting blinds to photovoltaic-powered refrigerator units and irrigation pumps. The audience of 500 included government officials from 17 Caribbean Basin countries, as well as businessmen, journalists and academics with an interest in renewable energy. One entire day of the symposium was devoted to discussions of investment and finance for renewable energy, in which I had the privilege of participating.

As a result of the symposium and exhibit, 15 of the U.S. participants reported finding potential distributors and/or joint venture partners and even more impressive, nearly a quarter of a million dollars in sales were consummated on the floor and $5 million in 12 month sales projections were anticipated. The apparent success of the Kingston symposium and exhibit from OPIC's vantage point suggests that the Caribbean is, indeed, a promising market for U.S. alternative energy technologies.

In between our large insurance program on the one hand and our modest investment encouragement efforts on the other, OPIC has fostered technology transfer both in the investment projects we support -- which typically provide significant training opportunities for host country nationals -- and through our training grant program.

While much of the international dialogue on technology transfer is concerned with the question of access, OPIC recognizes that many local firms in the developing world are hindered not so much by an inability to obtain technology, but rather by the difficulties they encounter in selecting technologies appropriate to their needs and capabilities. Moreover, the acquisition of these technologies is often accompanied by the failure to assimilate correctly newly-acquired techniques into plant operations.

In the Southeast Asian region, a high growth area for new technology, American firms face the added disadvantage of competing with aggressive Japanese and European programs of technology acquisition and management training. Until recently, there was no U.S. equivalent to these programs, and American technology suppliers -- including small and medium-sized manufacturers of conservation and renewable energy technology -- were at a strong competitive disadvantage.

On May 11, 1982, OPIC entered into an agreement with the Fund for Multinational Management Education (FMME) to establish self-sustaining technology training programs in each of the five countries that belong to ASEAN -- the Association of Southeast Asian Nations. These include the Philippines, Indonesia, Malaysia, Thailand and Singapore. Each participating institution in these countries will train between 40 and 50 ASEAN executives each year in the skills necessary to plan, purchase, install and manage U.S. technology for their companies. The continuity of U.S. participation will be ensured by FMME's on-going role in providing U.S. faculty for the courses as well as serving as a liaison between the U.S. and ASEAN business communities.

By increasing ASEAN executives' familiarity with U.S. technology and technology management techniques, this program will directly improve small and medium-sized U.S. companies' access to the ASEAN market. As ASEAN firms look increasingly to the U.S. as a source of supply and a technology partner, exports of U.S. technology, intermediate goods, and capital equipment will grow.

Now, let me turn to the Subcommittees' interest in our plans for the future. To a large extent OPIC's role will depend on the commercial opportunities in the Third World available to U.S. suppliers of solar and conservation technologies.

From the perspective of OPIC insurance that might be issued, the outlook is promising. Eight applications are currently pending for investment projects for the development and application of renewable energy technologies. These include three gasohol projects, two geothermal projects, two wood and charcoal production facilities in Asia and Latin America and a solid waste energy conversion project in Southern Europe. The total estimated value of these investments is $366 million. I must, however, caution that these investments are in the planning stages and OPIC has not made any final commitments to these projects. Indeed, in many instances, the investor has not made a final commitment to go ahead with these projects.

In planning for our investment missions, we consult closely with host country governments regarding the sectors they regard as having a high priority and investment opportunities they may identify. In the case of our forthcoming October mission to the Eastern Caribbean, we have been asked to recruit investors with an interest in solar driers, heaters, and coolers, biogas, wood cookstoves and windmills. In addition, the government of Pakistan, where we are planning a mission for December, has expressed an interest in manufacturing solar-powered water pumps for irrigation. Needless to say, OPIC's Marketing Department is currently seeking to recruit U.S. executives from these sectors to participate in these investment missions.

We at OPIC hope and expect that our enhanced efforts to promote investment in the developing world will stimulate and facilitate increased U.S. private investment in the international production and sale of conservation and renewable energy technologies. We share your concern about the need for enhanced U.S. exports of these technologies both for the sake of development and to accelerate their application to our own energy needs here at home. From the standpoint of OPIC's development mandate we see no problems in providing U.S. businessmen with insurance and other support within the limits of our statute, our budget and manpower. In general, we believe that alternative energy is inherently developmental both in macroeconomic and micro-social and economic terms. We see definite trade benefits for the United States in promoting the sale of these technologies abroad and we are aware of the competition faced by U.S. companies.

We, therefore, look forward to assisting U.S. firms in this endeavor and welcome your advice and suggestions.

Thank you.

Mr. GORE. Thank you very much. And thanks to all of you.

Let me begin questions with Mr. Vanderryn.

I understand administration policy toward Third World regional energy projects is to "stress technical assistance rather than resource transfers."

That is from an internal memo. What is the rationale for this policy? Can you give examples of programs to transfer skills and know-how rather than funds?

Mr. VANDERRYN. Mr. Chairman, we have found that the capability of the developing countries to develop new technologies is very much dependent on increasing their own technical capabilities and their institutional capabilities.

It is difficult to transfer technology or transfer equipment unless there is a basic capability in the developing country to absorb that knowledge and know-how. So our activities focus very much, as I indicated in my statement, on training and on institution building. We are doing this in a number of countries.

We are also running, for example, an alternative energy training course at the University of Florida in which we bring developing country experts to this country to provide them an overview of the various renewable technologies and to provide them some methodology by which they can make their own choices as to which of these technologies make sense in their own setting in their countries.

Mr. GORE. Now, let me ask you about the AID budget request for renewable energy.

Back in the fall of 1980, Steven Klein, from AID, testified that AID's renewable energy activities would be about $34 million in fiscal year 1980, $78 million in fiscal year 1981.

What are the current projected levels for fiscal year 1982 and fiscal year 1983?

Mr. VANDERRYN. Mr. Chairman, as I indicated, our total budget in the energy area in 1982 is about $72 million, of which $34 million is in the renewable energy area. Our 1983 request is approximately at the same level.

Mr. GORE. So that has been cut by more than 50 percent?

Mr. VANDERRYN. I am not familiar with the figures you are quoting. They sound like the total energy figures rather than renewable.

Mr. GORE. It was a figure for renewable energy. That was September 5, 1980, Steven Klein testified to the Senate committee, that the figure for renewable would be $78 million in fiscal year 1981. You can supplement that for the record.

Mr. VANDERRYN. I would have to submit that for the record, Mr. Chairman.

Mr. GORE. A report out of the Library of Congress, from the CRS, this month states, and I quote:

> Currently AID policy is intended to foster host country renewable energy equipment producers. The implication of this seemingly cooperative policy is to curtail severely potential export markets for U.S. regional energy equipment.

Is that a fair description of your policy?

Mr. VANDERRYN. Mr. Chairman, one of the things, especially in the renewable energy area, where a number of technologies are capable of being produced within the developing countries, is to encourage joint ventures between U.S. industry and industrial capability in the developing countries.

I think we have to recognize that these countries are interested in building up their own capabilities, their own industrial production, and therefore it is not always possible for us to simply consider an export market where U.S. firms would export all of their equipment. I think there are many opportunities for joint ventures.

As I indicated, our bureau of private enterprise is encouraging this kind of approach. I think in this way U.S. industrial capability can be used to help both these countries as well as to help our export markets as well.

Mr. GORE. You stated in your written testimony that only one U.S. manufacturer currently makes a crossflow turbine, because of a very limited market which was anticipated for that equipment.

Do you have any formal mechanism for transmitting the information about markets in Third World countries to U.S. manufacturers?

Mr. **Vanderryn**. As I mentioned, Mr. Chairman, the NREC later this month is planning a meeting with all of the U.S. manufacturers to discuss the basis of the experience that our AID sponsors and missions have had in the developing countries, and to get a sense from U.S. industry as to what their problems are, what their interests are, so we can work in a more organized way with our industry to promote whatever interests they have within the limitations of our own development assistance program.

Mr. **Gore**. Well now, is the workshop going to cover as one of its topics, this problem of information transfer, information about opportunities overseas, and foreign markets for U.S. manufacturers?

Mr. **Vanderryn**. That is certainly one of the goals of the workshop.

Mr. **Gore**. Is it a topic? Is it a discrete topic to be discussed at the workshop?

Mr. **Vanderryn**. Yes, we would discuss the various missions that we have had and the knowledge that we have gained to date about what potential markets are in these countries.

Mr. **Gore**. But, that is a little bit different than addressing the problem of how to do that on an ongoing basis. Learning the lessons of the past and transferring information in a one-time workshop is one thing and a laudable goal but is somewhat different. Would you agree?

Mr. **Vanderryn**. We will certainly be asking the industry as to what kind of information transfer in terms of what knowledge we have gained is useful to them on a regular basis, and we would certainly try and do what we can.

Of course, that is within the limits of the budgets and the manpower that we have available.

Mr. **Gore**. OK. Mr. Hardy, last week, both Mr. Heginbotham and Mr. Mead criticized the low funding level for TDP. According to Mr. Mead's testimony, "The current program funding level for TDP is $5 million contrasted with comparable programs in the European community funded at $40 to $60 million, and the Japanese program estimated to be of more than $100 million."

Can you explain why the largest Western industrial nation spends so little on this important form of export assistance?

Mr. **Hardy**. I believe those figures relate to not only the solar area, but that is TDP's entire program, and the figures for Japanese and the Europeans relate to all of the work that they are doing.

Mr. **Gore**. What is a comparable figure for TDP?

Mr. **Hardy**. That figure is correct. This year, the program budget is $5 million.

Mr. **Gore**. For?

Mr. **Hardy**. Feasibility studies worldwide.

Mr. **Gore**. For everything?

Mr. **Hardy**. Yes.

Mr. **Gore**. Well, what is your complaint with that?

Mr. **Hardy**. I only wanted to make clear that it is not restricted to the solar energy area, but rather those figures are for projects worldwide.

Mr. **Gore**. For everything?

Mr. HARDY. The trade development program, as I mentioned, is a young program.

In light of the severe budgetary situation that exists, this administration has been cautiously supporting the program.

It has expanded substantially in the last several years from the financial levels which it was at that time, and we would hope, and I believe it is the intent of this administration, to further expand the program budget. The difficulty is in light of the present financial situation, it is difficult to substantially expand.

I think another issue involving this is that it is the position of this administration that export subsidies are a distortion of the free market mechanism that this administration recognizes. Within the international trade area, there are severe imperfections to that mechanism, and, as a consequence, we seek through TDP, where possible, to try and narrow the margin between what other governments are offering and the situation in which U.S. firms find themselves, but, as a value, itself, the export subsidy is not something this administration values—in fact, is very much opposed to.

It strongly disagrees with the position that has been taken by the European community countries and the Japanese in terms of much larger programs in this area.

Mr. GORE. Now, your procurement is subject to AID procurement regulations; is that correct?

Mr. HARDY. Well the trade development program was formerly a part of AID, and at the time that it was established a separate organization a position was taken, and has since been followed, that we will continue to follow AID regulations with regard to procurement, except for where the trade and development program has made a separate policy decision.

To date, we have found that in light of the small budget and a great demand on our budget, that we do not have the resources to separate procurement regulations and have to date followed the AID regulations.

Mr. GORE. I note that TDP apparently feels restricted by the financing plans for developing nations. Several years ago, Eximbank was willing to give preliminary commitment letters in support of projects with favorable TDP finance feasibility studies.

Wouldn't this give TDP a strong position to be more supportive of industry-initiated proposals for feasibility studies?

Mr. HARDY. The trade and development program, since we are involved in the preliminary project stage, we must follow the lead of the developing countries in terms of where they want to place their priorities and where they want to place their limited amount of funds.

To date, while the developing countries are moving very heavily away from oil-base energy sources, it has been our experience that they have tended to move more toward coal, and, as a consequence, we have followed their lead in that area. Where they have expressed interest in the solar energy area, we have participated in that, again primarily at a stage very early where Eximbank would not necessarily be involved.

The activities in which TDP have been involved in the solar area have been the type of symposium activities which are really preproject. That is, it is an effort to get the U.S. solar energy community together with the decisionmakers in countries which have expressed interest in this area out of which hopefully will come specific projects which then the Eximbank and other sources may be interested in providing the financing.

Mr. Gore. Well, suppose somebody in the renewable energy industry took the initiative and identified countries where their technology appeared to have the greatest competitive advantage and then came to TDP with a proposal a feasibility study. What would your reaction be?

Mr. Hardy. We would review the proposal, and if the question of financing has been not necessarily resolved, but if there is some reasonable likelihood that follow-on financing would be available, then we would be pleased to consider the project and provide feasibility or prefeasibility, depending on whatever stage the project is in, and to participate in attempting to develop that project to the point where it could move forward in implementation.

Mr. Gore. Would TDP consider supporting in such instances a feasibility study proposal to those countries identified by the industry?

Mr. Hardy. Absolutely.

Mr. Gore. All right. Dr. West, I guess that acronym has really been an albatross the last few years?

Mr. West. Yes, it has.

Our president, Craig Nalan, has remarked that his mother still believes he is working for the Arabs.

Mr. Gore. It might even cost you a few points on the floor when OPIC is mentioned.

Mr. West. That did not cause us great difficulties last year in our reauthorization hearings.

Mr. Gore. Is it your mandate to be self-sustaining, or is that just a policy?

Mr. West. No, it is very much a part and parcel of our statute; that we are to be a self-sustaining agency, and exercise prudent risk management in our activities.

Mr. Gore. Well, insofar as OPIC is making so much money, so to speak, has any consideration been given to reducing its rates?

Mr. West. Mr. Chairman, we reviewed about 2½ years ago our entire premium rate system, and changed that system from one which is essentially based on flat rates for the various coverages for all projects regardless of where they occurred in the world to a much more flexible system, which is called a scheduled premium rate system. There are base rates for various industries, and depending on the risk profile of the project, that base rate could be adjusted upward or downward, much like many life insurance policies that have base rates for various ages and are modified by how many heart attacks you might have had already.

We feel that this new system gives us the flexibility to charge equitable rates to businessmen that come to us for coverage, and gives us the flexibility to be both prudent when the situation merits it, as well as to reduce the rates when the risk is not as great. So I think that that system is flexible enough to adapt to any changes in our financial status.

We have tended to move toward expanding our services, filling in gaps and needs that have been identified by U.S. businessmen in their overseas activities. That seems to be the inclination of our current management, and certainly in the next few years we anticipate an expansion of our services rather than alterations in our rate structure.

Mr. GORE. Can you tell me why both OPIC and TDP finance feasibility studies?

Mr. WEST. At the risk of being overly concise, TDP concentrates on feasibility studies for U.S. export opportunities, whereas OPIC confines itself to feasibility studies for U.S. investors looking at investment opportunities.

We have worked hand-in-hand with TDP on projects that might involve assistance from both of us, where there is both a trade opportunity and an investment opportunity to a U.S. business firm, and we coordinate very closely to make sure we don't step on one another's toes in that area.

Mr. GORE. Have you ever faced the criticism that in some cases your program might encourage the location of an American investment in a foreign country instead of in the United States?

Mr. WEST. Yes, we have, Mr. Chairman.

As part of our statute, we are forbidden to assist runaway U.S. plants. Someone, for example, who wants to shut down his plant in Kentucky and move it lock, stock and barrel to some Caribbean country, will not be able to obtain OPIC insurance.

We are also obliged by statute to do a review of the effects of that project on the U.S. economy, not just on that particular firm, but on the entire industrial sector of which it is a part. So if it is a shoe company, we would review the effects of that proposed shoe investment in the Caribbean on the entire U.S. shoe industry. We are also obligated to review the effects, if any, of trade-related performance requirements that might be placed on the investor by the host country, obliging him to do certain things.

We have, over the last 10 years, turned down about 75 projects that came to us for assistance on the grounds that we believed it would harm the U.S. economy in one way or another. Sometimes these decisions are quite painful, because the projects are very attractive from a development perspective, but I believe we have a pristine record in never assisting an investor whose project would cause harm to the U.S. economy. The GAO reviewed this in some detail about 2 years ago, and our friends at the AFL-CIO are fairly religious in their oversight activities in this area, and, thus far, we have not been found to have transgressed.

Mr. GORE. How about small business?

How do you measure your effectiveness in increasing opportunities for small business?

Mr. WEST. Well, I could point to several things, Mr. Chairman. First, is a very elaborate outreach effort on our part that began about 1977, in which we, together with the Export-Import Bank, Commerce Department, and SBA, actually traveled around to many cities in the United States—some 75 cities—and put on rather extensive seminars to inform businesses, especially small businesses, of the programs of our respective agencies.

I think the thing I would point to as perhaps the best indication of our activity is that 30 percent of the insurance and finance activities for the last 3 years, by project count, have been with U.S. small businesses. That is perhaps the best indication.

We make a special effort in the recruitment for our investment missions to find small businesses, to let them investigate firsthand the opportunities that exist in certain developing countries. I might add that we do not take a passive role in this area. If we find an investment opportunity, be it in the solar area or any other area, we try to actively recruit people for our investment missions from those sectors, or actively find another U.S. investor to take them up.

Mr. GORE. Do you coordinate your trade promotion symposiums with ITA?

Mr. WEST. Our seminar and conference activities tend to be focused on the investment area rather than the trade area, and, as such, we only participate on a somewhat sporadic basis in the ITA-sponsored seminars and conferences, since they are primarily focused on trade activity, and we are not fundamentally in the trade promotion business.

Mr. GORE. Okay.

Mr. Hardy, Mr. Mead, at our hearing last Thursday, stated that your program has "funded very few renewable projects and has no plans for doing more in this area."

Is that true?

Mr. HARDY. No, it is not.

We have reviewed the projects that we have done, and we are presently considering a number of projects right now.

Again, one of the difficulties that we have is that we essentially follow the lead of the governments, and their interest in terms of the sectors that they are interested in, the types of projects for which they intend to devote their financing.

Mr. GORE. If foreign governments fund feasibility studies instead of the United States, doesn't that make it likely that foreign technologies will be purchased by the host country rather than U.S. technologies?

Mr. HARDY. Yes, it generally does.

Mr. GORE. From your testimony it sounds as though TDP has a much narrower and more restricted conception of its role than was the case 3 years ago. For example, why is it that you now feel limited by foreign financing when Eximbank and U.S. investor financing were previously included in the program objectives?

Mr. HARDY. I would think that the program now is substantially broader than it was at that time.

Clearly, if there is any possibility of Ex-Im participation in projects, and there are projects in which the Trade and Development Program has done feasibility studies, and as the project has moved on into the implementation stage, the Eximbank has provided financing for portions of that.

I guess that my conclusion is that I would disagree with that statement. I think that in the past we have closely coordinated to a great extent with other agencies as we have broadened our approach in terms of moving out into the private sector and encouraging the private sector.

Three years ago, the TDP was involved primarily, if not exclusively, with the use of U.S. Government technical assistance, and did not resort to the private sector at all.

Mr. **Gore**. Mr. Vanderryn, have there been any major policy changes in the AID renewable energy program since the current administration took over?

Mr. **Vanderryn**. No, I would not say so, Mr. Chairman.

What I would say, however, is that over the last few years our programs, I think, have come somewhat more in balance, recognizing not only the importance of renewable energies, but also the importance of the more traditional areas such as fossil fuels, so that our overall activities, if you look at the balance between these areas is perhaps increasing somewhat in the conventional areas, recognizing that in terms of producing oil imports and affecting the overall financial situation of countries, that the conventional energy areas are also very important.

Mr. **Gore**. OK. Mr. Hardy, you stated the third objective of TDP is, "to facilitate access to resources of interest to the U.S." What does that mean?

Mr. **Hardy**. Well, the Trade and Development Program has a specific statutory mandate to do just as you have quoted.

Mr. **Gore**. Yes.

Mr. **Hardy**. We have been, in conjunction with a number of other agencies which have authority in this area, undertaking an analysis to determine to what extent TDP may have a role.

The preliminary conclusion that we have come to is that there may be situations in which a very small amount of TDP funding could be used to provide studies, to eliminate bottlenecks or problem areas which have precluded development of these resources, and interest in them by the U.S. private sector.

It would be our effort to try and move into this area very cautiously to see if we can't play a role in eliminating some of these bottlenecks.

Mr. **Gore**. OK. We are running short on time, so we will have to move on to the next panel. Let me thank all three of you for your testimony here today and for the time and effort that went into it, and we look forward to working with you in the future.

Thank you very much.

I am going to have to ask for a recess for about 5 minutes. We will come back in 5 minutes.

[Brief recess.]

Mr. **Gore**. The subcommittee will come back to order.

If our guests would cooperate, we will get the hearing underway.

Our last two witnesses are John D. Bierman, senior vice president for export credits, guarantees and insurance, Export-Import Bank, and Donald Earnshaw, deputy assistant director, export development, at the International Trade Administration, with the U.S. Department of Commerce.

Gentlemen, welcome to you.

Without objection, your prepared statements will be put into the record in full, and we will invite you to proceed.

Mr. Bierman, you may lead off; please go ahead.

STATEMENT OF JOHN E. BIERMAN, SENIOR VICE PRESIDENT, EXPORTER CREDITS, GUARANTEES AND INSURANCE, EXPORT-IMPORT BANK OF THE UNITED STATES

Mr. **Bierman**. Mr. Chairman, I welcome the opportunity to appear before you today to discuss the Export-Import Bank's programs and our role in supporting export sales of U.S. equipment and services for use in renewable energy. As requested by you, I would like to summarize a formal statement which we have presented for you.

The purpose of Eximbank is to aid in financing and facilitate export sale of U.S. goods and services through a combination of loans, loan guarantees and export credit insurance for those sales which offer a reasonable assurance of repayment. The Export-Import Bank Act instructs us to provide financing for U.S. exporters which is competitive with that offered to their foreign competitors by their governments, but in so doing to supplement, and not compete with, private financing.

Eximbank does not operate on appropriated funds; we fund our operations with our capital base, which now amounts to approximately $3 billion, plus borrowings through the Federal Financing Bank. In this connection, the bank's charter also instructs our board of directors in setting our loan rates to take into account the cost of funds to the bank as well as the mandate to be competitive. This, of course, has presented a dilemma for our board as interest rates increased and competition from foreign subsidized financing intensified in many of the key sectors using Eximbank loans.

The bank made a profit on its operations annually for many years, from which it paid over $1 billion in dividends into the U.S. Treasury and accumulated $2 billion in reserves, but this year—for the first time in its 48-year history—we are expecting to have an operating deficit as a result of our increased borrowing costs of $120 million.

We expect those deficits to continue until at least the next 1 or 2 fiscal years.

The bank's programs are divided into two functional categories: Buyer-credits and supplier credits. The buyer credit programs are comprised of loans from Eximbank and financial guarantees on financing provided by the private sector, generally from commercial banks, for sales of equipment for large projects or products which require a repayment term of 5 or more years. Some examples are equipment for electric power generation, mining projects, and ground and air transportation.

The supplier-credit programs are designed to cover those export transactions which are funded by the private sector, generally for sales with a value of $5 million or less which are repaid within 5 years. In the commercial bank guarantee and export credit insurance programs, the private sector extends the financing and we assume most of the risk of nonpayment by the foreign buyer for commercial or political reasons.

These programs cover the day-to-day trade of the United States ranging from consumer goods to high technology items, as well as services exports such as feasibility studies and architectural and engineering contracts.

Over the years, Eximbank has supported a substantial amount in export sales of U.S. equipment and services for use in energy projects abroad, although much of this naturally has been in the nuclear and conventional power generation sectors.

We also have assisted in coal development projects abroad, through both our direct loan program and for products financed on medium-term, in addition to supporting a moderate amount of U.S. coal exports through short-term insurance cover.

Energy recovery or more efficient utilization of energy resources is an integral part of the engineering review of many of the projects in which Eximbank participates. This energy review is taken into account in the application of the technical "state-of-the-art" in designing a technically feasible and economically viable project.

We have promoted conservation by offering financing support, for example, for automated dispatch systems for electric utilities, waste heat recovery systems for gas turbine generators, and improved electrical power transmission and distribution systems.

In 1978, Congress added a provision to the Eximbank charter requiring the board of directors to name an officer of the bank whose duties would include advising the president of the bank on ways of promoting the export of U.S. goods and services in the nonnuclear renewable energy resources area, disseminating information on such export opportunities and the availability of Eximbank support, and to act as the bank's liaison with other Government agencies in this area.

I was designated for that position, which I continue to hold. I should add that I am also the bank's Small Business Officer, so I am very familiar with the requirements which these size businesses have in their export efforts.

In looking into the best ways to implement that provision in our law, we found some considerable variation in the technological development and availability of U.S. equipment and services in the various renewable energy resources fields.

Therefore, given the basic purpose of Eximbank, we felt that one of the best ways to start in such specific areas as solar energy, for example, was through a broad information program to acquaint the industry with the bank, its programs, and how to use them.

We have done this through participation in numerous industry conferences, symposiums and meetings, as well as consultations with individual exporters. We have explained that in addition to our loan officers who evaluate the proposed project and financing proposals, we also have an engineering staff to help evaluate the technical aspects of the proposed project or product sale and attorneys who are available to assist in preparing loan agreements and other required legal documentation.

We also queried our counterpart export financing entities in other countries to determine whether they had any export credit programs especially designed for renewable energy resource exports and determined that those countries financed such exports under their regularly available programs.

In summary, let me emphasize that Eximbank's officers and staff are very interested in export sales which would promote the adoption of all types of renewable energy resources abroad; we have financing support programs available to help U.S. exporters bid on these sales, and we will make every effort to try to tailor the financing offer to meet foreign government-supported competition.

Thank you for inviting us to be here today to participate in your discussions on this important issue. I would be pleased to answer any questions you may have on Eximbank and export financing.

Thank you.

[The prepared statement of Mr. Bierman follows:]

Statement of
John D. Bierman
Senior Vice President for
Exporter Credits, Guarantees and Insurance
Export-Import Bank of the United States

at a Joint Hearing before the

Subcommittee on Energy Development and Applications
and
Subcommittee on Investigations and Oversight
House Committee on Science and Technology

Monday, June 21, 1982

Mr. Chairmen, Members of the Subcommittees:

I welcome the opportunity to appear before you today to discuss the Export-Import Bank's programs and our role in supporting export sales of U.S. equipment and services for use in renewable energy.

First, in accordance with the Committees' request, I would like to summarize briefly Eximbank's charter. The purpose of Eximbank is to aid in financing and facilitate export sale of U.S. goods and services through a combination of loans, loan guarantees and export credit insurance for those sales which offer a reasonable assurance of repayment. The Export-Import Bank Act instructs us to provide financing for U.S. exporters which is competitive with that offered to their foreign competitors by their governments, but in so doing to supplement, and not compete with, private financing.

Eximbank does not operate on appropriated funds; we fund our operations with our capital base, which now amounts to approximately $3 billion, plus borrowings through the Federal Financing Bank. In this connection, the Bank's charter also instructs our Board of Directors in setting our loan rates to take into account the cost of funds to the Bank as well as the mandate to be competitive. This, of course, has presented a dilemma for our Board as interest rates increased and competition from foreign subsidized financing intensified in many of the key sectors using Eximbank loans. The Bank made a profit on its operations annually for many years, from which it paid over $1 billion in dividends into the

U.S. Treasury and accumulated $2 billion in reserves, but this year--for the first time in its 40-year history--we are expecting to have an operating deficit as a result of our increased borrowing costs of $120 million.

The Bank's programs are divided into two functional categories: buyer-credits and supplier credits. The buyer credit programs are comprised of loans from Eximbank and Financial Guarantees on financing provided by the private sector, generally from commercial banks, for sales of equipment for large projects or products which require a repayment term of five or more years. Some examples are equipment for electric power generation, mining projects, and ground and air transportation. These programs usually operate on a two step procedure: (1) issuance of a Preliminary Commitment for use in the bidding stage and (2) if the U.S. exporter gets the order, conversion of the Preliminary Commitment into a loan and/or financial guarantee.

Under the Preliminary Commitment procedure Eximbank will, upon request, outline in a preliminary commitment letter the terms and conditions of the financial support it would be prepared to consider on a sale of U.S. goods and services to a foreign purchaser. The applicant must provide information sufficient to enable the Bank to approve the technical, economic and financial aspects of the proposed project. This early indication of financing support has been of great assistance to many U.S. exporters in their overseas sales efforts. In addition, it provides Eximbank with a good indication of the amount of credit assistance which it may be called upon to provide in support of U.S. exports.

Eximbank's interest rate on direct loans is now 12%, which is lower than the Bank's marginal cost of funds. However, our Board believes this rate is necessary to enable U.S. exporters' financing packages to be competitive with foreign officially-supported export financing packages. In this connection, the United States Government led by Eximbank and the Treasury have undertaken intensive negotiations with member countries of the Organization for Economic Cooperation and Development to increase minimum interest rates on officially supported export credits in order to reduce and ultimately eliminate subsidy in export credit so that sales decisions can be made on the basis of product, quality, delivery, and other usual factors. As you may know, we currently have pending a proposal to modify the existing Arrangement to increase these minimum rates and bring certain countries into higher rate brackets. We believe this is the only sensible answer in the long run for all countries as it would put U.S. exporters of all types of products on a more equitable and competitive basis.

The supplier-credit programs are designed to cover those export transactions which are funded by the private sector, generally for sales with a value of $5 million or less which are repaid within five years. In the commercial bank guarantee and export credit insurance programs, the private sector extends the financing and we assume most of the risk of nonpayment by the foreign buyer for commercial or political reasons. These programs cover the day to day trade of the United States ranging from consumer goods to high technology items, as well as services exports such as feasibility studies and architectural and engineering contracts. Although you tend to hear more about the Bank's direct loan program because of the nature and size of the transactions, actually we support far more sales, both in numbers and total export value, under the commercial bank guarantee and insurance programs.

The export credit insurance program offers coverage on both short-term (up to 180 days) and medium-term (repayment from 181 days to 5 years) sales and is operated by Eximbank in conjunction with the Foreign Credit Insurance Association (FCIA), a group of some 50 of the nation's largest marine and casualty insurers. FCIA processes the application and takes most of the commercial risk; Eximbank takes all of the political risk. As in the direct credit program, in any medium-term transaction the buyer makes a 15% cash payment, the commercial bank or exporter must take a portion of the financing risk for their own account (except in the case of small businesses), and Eximbank/FCIA assume the risks on the remaining amount.

In addition to guarantees and insurance, our Discount Loan Program has been available to support medium-term sales with a contract value of $2.5 million or less. This program was designed to overcome limitations in the private market's ability to offer fixed rate financing for export sales by offering commercial banks a standby loan commitment from Eximbank against that export paper at a spread of up to 1% below the banks' rate to their customers. We intend to target this program to small business exporters next year.

Over the years, Eximbank has supported a substantial amount in export sales of U.S. equipment and services for use in energy projects abroad, although much of this naturally has been in the nuclear and conventional power generation sectors. We also have assisted in coal development projects abroad, through both our direct loan program and for products financed on medium-term, in addition to supporting a moderate amount of U.S. coal exports through short-term insurance cover.

Eximbank has been involved in several oil and gas development projects, a number of which are directly related to either the conservation of associated gas that is produced with the oil and flared (wasted) or the secondary recovery methods to increase proven oil reserves. We have authorized several credits and also have outstanding Preliminary Commitments for such projects in a number of countries world-wide.

Energy recovery or more efficient utilization of energy resources is an integral part of the engineering review of many of the projects in which Eximbank participates. This energy review is taken into account in the application of the technical "state-of-the-art" in designing a technically feasible and economically viable project. We have promoted conservation by offering financing support, for example, for automated dispatch systems for electric utilities, waste heat recovery systems for gas turbine generators, and improved electrical power transmission and distribution systems.

We have also participated in a number of hydroelectric projects, including, for example, a recently authorized direct loan of $95 million to support U.S. exports valued at $136 million for a dam and hydroelectric facility in the Ivory Coast. Eximbank is participating with AID in the Aswan II hydro project in Egypt. These are examples of where U.S. technology is readily available, highly competitive and utilizes Eximbank financing for export sales.

In 1978 Congress added a provision to the Eximbank charter requiring the Board of Directors to name an officer of the Bank whose duties would include advising the President of the Bank on ways of promoting the export of U.S. goods and services in the nonnuclear renewable energy resources area, disseminating information on such export opportunities and the availability of Eximbank support, and to act as the Bank's liaison with with other government agencies in this area. I was designated for that position which I continue to hold. I should add that I am also the Bank's Small Business Officer so I am very familiar with the requirements which these size businesses have in their export efforts.

In looking into the best ways to implement that provision in our law, we found some considerable variation in the technological development and availability of U.S. equipment and services in the various renewable energy resources fields. Therefore, given the basic purpose of Eximbank, which is to facilitate and finance export sales which cannot be done solely by the private market, we felt that one of the best ways to start in such specific areas as solar energy, for example, was through a broad information program to acquaint the industry with the Bank, its programs, and how to use them. We have done this through participation in numerous industry conferences, symposiums and meetings, as well as consultations with individual exporters. We have explained that in addition to our loan officers who evaluate the proposed project and financing proposals, we also have an engineering staff to help evaluate the technical aspects of the proposed project or product sale and attorneys who are available to assist in preparing loan agreements and other required legal documentation. We also queried our counterpart export financing entities in other countries to determine whether they had any export credit programs especially designed for renewable energy resource exports and determined that those countries financed such exports under their regularly available programs.

We have had a number of inquiries on potential projects and have offered financing support for those proposed sales which were technically and financially sound. For example, we recently approved a $2.3 million export credit insurance policy for equipment sales for a new fuel pelletizing plant in Colombo, Sri Lanka. This plant will utilize the coconut stems, residue husks and bulbs of minimum production coconut trees to produce a fuel replacement for oil imports. In the geothermal area, we are anxious to support U.S. bidders on viable projects and, in fact, have authorized one credit to finance geothermal exploration and development drilling in the Philippines and have outstanding a Preliminary Commitment on financing for another project there.

We have issued Preliminary Commitments for a variety of alternative energy sources in addition to hydroelectric and geothermal power, such as co-generation of electricity by incineration of municipal garbage, steam generators fired by waste gas from refineries and coal gasification. A Preliminary Commitment has also been approved for $2.1 million for a solar powered microwave rural telephone system that will provide communication service for approximately 800 small towns in Peru. The U.S. bidders have not gotten all these contracts, but not for lack of financing support.

In summary, let me emphasize that Eximbank's officers and staff are very interested in export sales which would promote the adoption of all types of renewable energy resources abroad, we have financing support programs available to help U.S. exporters bid on these sales, and we will make every effort to try to tailor the financing offer to meet foreign government-supported competition.

Thank you for inviting us to be here today to participate in your discussions on this important issue. I would be pleased to answer any questions you may have on Eximbank and export financing.

For Your Information
From the Office of Public Affairs
The Export-Import Bank of the United States

JOHN D. BIERMAN
Senior Vice President
Exporter Credits, Guarantees and Insurance
EXPORT-IMPORT BANK OF THE UNITED STATES

John D. Bierman joined Eximbank in April 1967 as a Loan Officer in the Exporter Credits, Guarantees and Insurance Division. He was Deputy Vice President, Exporter Credits and Guarantees from October 1971 until April 1972, when he assumed the position of Deputy Senior Vice President, Exporter Credits, Guarantees and Insurance. In February 1976, Mr. Bierman was appointed to his present position as Senior Vice President. His duties and responsibilities encompass the administration of the Commercial Bank Exporter Guarantee, FCIA Insurance, Discount Loan and Claims programs. Additionally, Mr. Bierman is the Bank's Small Business Liaison Officer and the Bank's representative on the Board of Directors of the Foreign Credit Insurance Association.

Mr. Bierman has been the Bank's representative at numerous meetings of the Berne Union, an international association of credit and investment insurers.

A native of Iowa, Mr. Bierman holds a B.S. in Business Administration from Drake University (1962). From 1962 until joining Eximbank, he was a loan officer in the rural telephone program of the Rural Electrification Administration, U.S. Department of Agriculture. He was active in the U.S. Naval Air Reserve from 1963 to 1969.

Mr. Bierman resides in Oakton, Virginia, with his wife, the former Christine Ann Irwin, and their three sons.

May 1982

Mr. **Gore**. Thank you very much.

We will hold our questions until Mr. Earnshaw has finished his statement.

Welcome. Please proceed.

STATEMENT OF DONALD V. EARNSHAW, DEPUTY ASSISTANT SECRETARY FOR EXPORT DEVELOPMENT, INTERNATIONAL TRADE ADMINISTRATION, U.S. DEPARTMENT OF COMMERCE

Mr. **Earnshaw**. While I am in charge of export development, I am representing this morning the International Trade Administration. I do welcome the opportunity both to describe the programs that we have to help the renewable energy area, and to describe, in a way that will be helpful to you, the way we are trying to do this.

There appears to be a bit of confusion in terms of how we are organized and what we do.

Unlike Dr. West, we are in the export promotion business. That is our job.

We do it through motivation and facilitation.

In the ITA there are three elements that comprise our export promotion activity: the commercial services, both U.S. and foreign; the trade development area; and the international economic policy [IEP] area. And it is that nomenclature that is confusing.

In ITA's prerealinement organization, all programmatic activity was in trade development, whether it was regional or sectorial, and all policy matters, whether they were regional or sectorial, were in IEP.

Following the realinement, all sectorial matters, whether they are policy or program, are in trade development, and all matters that are regional, whether they are sectorial, programmatic or policy, are in IEP.

It is a system that works. It will work very well. I have a mental picture of the sectorial industry officers working with industry to develop their export marketing programs, and a picture of the regional Deputy Assistant Secretaries and the foreign commercial service assessing the regional opportunities and the regional priorities. These flow together into what will be an excellent combination of industries' desires and the regional possibilities and potentials.

Let me move on, then, to page 3 of my oral testimony, and let's see how this works in the particular sector that is of interest here today.

In 1980, total production of renewable energy products, systems and equipment was approximately $120 million. Export sales were approximately $36 million, up 57 percent from 1979. There were 125 companies with recorded export sales in 1980, with 10 companies accounting for 70 percent of total exports.

The importance of ITA to U.S. renewable energy firms is the assignment of industry specialists within the Office of Capital Goods Industries to the alternate energy sector. These industry specialists work with the renewable energy industries trade association representatives and can effectively assist the industry in developing its export potential.

The basic framework used by the International Trade Administration in carrying out its export promotion responsibilities with industry is a comprehensive, multi-year export development plan. Developed through consultation with industry trade associations and trade groups, the export development plan represents a joint industry/U.S. Government cooperative approach to increase private sector activity in foreign markets.

The plan contains an economic/international trade profile of the industry, an export promotion and awareness strategy developed by industry representatives, and a plan of action based on those strategy elements acceptable to both industry and ourselves.

The export development plan provides a model for industry-Government cooperation in export promotion, and serves as a guide to the International Trade Administration on industry's foreign market interests and export promotion needs.

In November 1981, ITA completed an export development plan for the renewable energy industries. The executive summary of this export development plan has been distributed to the subcommittee members and a copy of the entire plan has been given to the subcommittee staff—Attachment 2. The plan focuses on the three most commercially viable industry sectors: solar thermal, photovoltaics, and wind energy.

In February of this year, the export development plan was distributed to the 141 Foreign Service and Foreign Commercial Service posts worldwide and to 47 U.S. Commercial Service district offices nationwide to increase their awareness of the renewable energy industry, its technology, market interests, and export capabilities.

With the assistance of representative industry groups, the export development plan will be revised later this year to expand its focus to the biomass and minihydroindustry sectors and to update the plan of action.

A major objective of export development activities is to encourage and support private sector initiatives designed to increase exports of U.S. goods and services. In carrying out this objective, we have encouraged the formation of trade association international trade committees and multitrade group export councils.

In March 1982, eight trade associations and trade groups, representing the commercially viable renewable energy industry segments, formed the Export Council for Renewable Energy [ECRE]. The council serves as a focal point for the promotion and expansion of the industry's international trade activities. The Commerce Department welcomes the establishment of this independent industry body, and offers its cooperation, whenever possible, in implementing the council's export promotion and export awareness objectives.

To supplement our efforts with the Export Council and individual trade associations, we are working closely with the trade publications serving the renewable energy sector. This provides an excellent marketing tool for reaching the new-to-export and new-to-market firms.

Announcements and articles regarding the International Trade Administration's export promotion activities have been and will continue to be published in these trade journals and newsletters.

The International Trade Administration has some 40 programs and services designed to assist individual U.S. firms by increasing their awareness of foreign market opportunities. Although too numerous to detail, Mr. Chairman, a representative listing of these export programs and services has been provided to the members and staff of the assembled subcommittees in attachment 4.

I would like to focus today on those ITA programs and activities which have proven particularly successful in supporting private sector efforts to develop markets overseas and in promoting U.S. renewable energy exports. These programs and activities include: One, the certification program; two, domestic export awareness seminars; three, Commercial News USA; four, major projects; and five, exhibitions and trade missions.

The Department of Commerce certification program promotes a number of major domestic and overseas trade shows to potential foreign buyers through the efforts of the Foreign Commercial Service in diplomatic posts around the world.

This program was utilized to encourage business and public sector representatives from developed and developing countries to attend the Solar Technologies Conference and International Exposition, held June 1-5, 1982, in Houston, Tex.

As a result of the department's certification program, over 200 foreign visitors—not including Canadians—were exposed to the latest U.S. renewable energy technology and products. The exposition organizer indicates that foreign buyers—including Canadians—constituted about 26 percent of total show attendance.

Exhibiting firms attributed the success of the exposition to the large foreign attendance, and reported both off-the-floor sales and preliminary discussions regarding licensing agreements and joint ventures with many of the foreign buyers. The International Solar Energy Exhibition, to be held in 1983, is also scheduled for foreign buyer support.

To develop awareness of the market opportunities for exports, ITA sponsors and organizes export awareness seminars in the United States. These are designed to inform U.S. firms of the necessary steps which must be taken in order to export their products. Firms which attend these seminars are provided with followup, individualized business counseling by the U.S. Commercial Service district office closest to them. In 1980 and 1981, 6 seminars were held for the renewable energy sector, attracting about 250 firms.

The Office of Major Projects within Trade Development assists U.S. renewable energy firms through the dissemination of trade opportunities received from Foreign Commercial Service posts for solar and other renewable energy technology and equipment projects. This answers an earlier question as to how the flow of information occurs to alert potential suppliers to potential opportunities. That is really our job, more so than that of the others who have testified previously.

Major projects officers are in contact with trade and development program [TDP] officials to discuss the possibilities of funding for renewable energy opportunities, as they arise.

The International Trade Administration publishes and distributes overseas a monthly magazine which promotes U.S. products and equipment. We published an exclusive issue of Commercial

News USA in fiscal year 1981 on the U.S. renewable energy industry. This publication was distributed to over 240 U.S. diplomatic posts, translated into the language of the foreign country, and redistributed to the local business community.

Through Commercial News USA, a U.S. company has the potential to reach over 250,000 foreign business executives and government officials. The success of this issue has led us to schedule another exclusive issue for the renewable energy sector in December 1983.

Mr. Chairman, one of the most effective methods of promoting U.S. goods and services in foreign markets is through Commerce-organized trade exhibitions and missions.

Exhibitions include country and industry trade fairs, solo fairs, catalog shows, and video catalog shows. Trade missions include officially sponsored seminar missions and specialized trade missions, as well as industry-organized Government-approved trade missions.

The International Trade Administration recognizes the importance of exhibitions and missions to high technology firms, including those in this area. Based on the successful trade events organized by the Department of Commerce and funded by the Department of Energy in fiscal year 1981, we are organizing four exhibitions and trade missions during the next 15 months exclusively for this industry.

These events include officially sponsored seminar trade missions to China, Thailand, the Philippines, and Taiwan; a catalog show during the Cyprus Fair; and a major energy fair in Singapore.

An additional fair in Venezuela and five trade missions featuring electric energy equipment are available for participation by the companies in this industry sector. In response to industry requests, the fiscal year 1984 plan proposes two trade fairs and five trade missions exclusively for renewable energy companies, and an additional five trade missions for electric energy manufacturers which are suitable for the participation of many companies in the renewable energy sector.

Exports of renewable energy technologies and devices should benefit considerably from enactment of export trading company—ETC—legislation. The legislation, strongly supported by the administration, seems almost made-to-order for this new and growing industrial sector.

The ETC is specifically designed to encourage small- and medium-sized companies that do not presently export—a description that I believe characterizes most of the businesses in the renewable energy field—to band together in joint marketing activities with banks or other large businesses with export know-how and financial resources to help defray risk.

Using the ETC vehicle, renewable energy consulting services, systems and components could be "packaged" by an export trading company, with participation by a major architectural, consulting or construction firm and/or banks or insurance companies to assist in financing major projects abroad.

A major feature of the Commerce Department's plans for implementation of this legislation is a clearing house operation in which ITA will put prospective client firms and principals in touch with each other. Since I am personally responsible for getting implementation on track, I can guarantee that we will do everything in our power—using the U.S. and Foreign Commercial Services, trade associations, development agencies of the States, and any other likely source of assistance—to see that renewable energy firms receive effective support and encouragement to participate in ETC's.

Our new Office of Service Industries is another key element in the effort to promote exports of renewable energy systems. That unit, charged with assisting consultants, engineers and other services firms to export, will seek to identify firms offering services related to solar and other forms of renewable energy and help introduce them to suitable foreign markets.

Mr. Chairman, the Department of Commerce recognizes the significance of developing country markets to the U.S. renewable energy industry, as well as the potential benefit to those countries in the development of their renewable energy resources.

U.S. renewable energy technology remains competitive, if not superior, to that of Japan and Europe. U.S. renewable energy firms have shown time and again an extraordinary interest in developing overseas markets. With the increased resources of the U.S. and Foreign Commercial Services, the proven success of its export promotion programs and activities, and the expertise of its country desk officers and industry specialists, ITA can provide these firms with the assistance that they need to commence or expand their exporting activities.

The success of the fiscal year 1981 Department of Energy/Department of Commerce renewable energy trade events and recent private sector initiatives, culminating in the formation of an industry export council, have led us to believe that the best way to increase renewable energy exports is through industry/government cooperation.

I would like to take the opportunity of this hearing, Mr. Chairman, to further pledge our commitment to work with the Export Council for Renewable Energy to achieve the goal which we both share, that is, development of export markets by U.S. renewable energy firms.

[The prepared statement of Mr. Earnshaw follows:]

STATEMENT OF DONALD V. EARNSHAW
DEPUTY ASSISTANT SECRETARY
FOR EXPORT DEVELOPMENT

TESTIMONY BEFORE THE SUBCOMMITTEE ON
ENERGY DEVELOPMENT AND APPLICATIONS AND
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT
OF THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY

June 21, 1982

Mr. Chairman and Members of the Subcommittees on Energy Development and Applications, and Investigations and Oversight, I am Donald V. Earnshaw, Deputy Assistant Secretary for Export Development in the U.S. Department of Commerce. I am pleased to represent the International Trade Administration to speak to you about the Promotion of U.S. Renewable Energy and Conservation Technologies in International Markets.

The topic of the Subcommittees' joint hearing is of importance and concern to all technology-oriented U.S. firms interested in foreign markets. Today, I will describe the positive steps that the International Trade Administration is taking to cooperate with the renewable energy industry associations to help this industry take advantage of international market opportunities.

ITA Responsibilities and Organization

The primary objective of the International Trade Administration is to promote an improved trade position for U.S industry in a manner consistent with national security and foreign and economic policies. The Under Secretary of Commerce for International Trade is responsible for carrying out this objective. Responsibilities within the International Trade Administration for the gathering of international economic and commercial intelligence, development of trade policy options, management of trade control, and the management of trade promotion activities are lodged respectively with the Director General of the U. S. and Foreign Commercial Services, and the Assistant Secretaries for International Economic Policy, Trade Administration, and Trade Development. Organizational charts have been distributed to Members and staff of both Subcommittees, Mr. Chairman, to illustrate the division of responsibilities within the International Trade Administration. (Attachment 1)

U. S. and Foreign Commercial Services

The 47 district offices of the U.S. Commercial Service have been merged with the 120 overseas posts of the U.S. Foriegn Commercial Service to constitute the U.S. and Foreign Commrcial Services. The U.S. and Foreign Commercial Services are the front-line source in the United States and abroad for U.S. businessmen seeking to explore the benefits of exporting and investing overseas.

International Economic Policy

Organized geographically by country and regional offices, International Economic Policy employs the services of a highly qualified professional staff of economists, trade specialists, and policy analysts who maintain in-depth knowledge of current economic and policy developments in their assigned countries. This knowledge is complemented by the expertise of the Foreign Commercial Service Officers through frequent post reports on country economic and commercial activities.

Trade Administration

ITA's Trade Administration manages the Commerce Department's trade control functions as required by the the Export Administration Act of 1979 and the Trade Agreements Act of 1979. Export Administration is responsible for the institution of export licenses and controls on U.S. goods and technology for reasons of national security and foreign policy. Import Administration administers the antidumping and countervailing duty program within the statuatory time limits imposed by the Trade Agreements Act.

Trade Development

The International Trade Administration's Trade Development organization has the primary responsibility for assisting the U.S. private sector in exporting goods and services through information and promotion programs and activities.

Our export promotion functions are the responsibility of my area of Trade Development, i.e., Export Development. Earlier this year, with the consent of the appropriate Congressional committees, the Commerce Department reorganized Export Development. The reorganization created industry-related offices to serve the export requirements of the Capital Goods, Consumer Goods, and Services Industries, as well as an office to manage and support trade events. Staff members in the industry-related offices are assigned responsibility for specific industries.

The importance of this reorganization to U.S. renewable energy firms is the assignment of industry specialists within the Office of Capital Goods Industries to the Alternate Energy Sector. These industry specialists work with the renewable energy trade association representatives and can effectively assist the industry in developing its export potential.

Export Promotion Framework

The basic framework used by the International Trade Administration in carrying out its export promotion responsibilities with industry is a comprehensive, multi-year Export Development Plan. Developed through consultation with industry trade associations and trade groups, the Export Development Plan represents a joint industry/U.S. Government cooperative approach to increase private sector activity in foreign markets. The Plan contains an economic/international trade profile of the industry, an export promotion and awareness strategy developed by industry representatives, and a Plan of Action based on those strategy elements acceptable to both industry and the Commerce Department. The Export Development Plan provides a model for industry/government cooperation in export promotion, and serves as a guide to the International Trade Administration on industry's foreign market interests and export promotion needs.

In November 1981, ITA completed an Export Development Plan for the Renewable Energy Industries. The Executive Summary of this Export Development Plan has been distributed to the Subcommittee members and a copy of the entire Plan has been given to the Subcommittee staff. (Attachment 2) The Plan focuses on the three most commercially viable industry sectors: Solar Thermal, Photovoltaics, and Wind Energy.

In February 1982, the export development plan was distributed to the 141 Foreign Service and Foreign Commercial Service posts worldwide and to 47 U.S. Commercial Service district offices nationwide to increase their awareness of the renewable energy industry, its technology, market interests, and export capabilities.

Structured by fiscal year quarter, the renewable energy export development plan lists specific events and activities recommended by the industry to increase the visibility and accessibility of export markets to individual U.S. firms. These industry recommendations will be the basis for determining ITA's FY '84 overseas trade events schedule for the renewable energy sector.

With the assistance of representative industry groups, the export development plan will be revised later this year to expand its focus to the biomass and mini-hydro industry sectors and to update the plan of action.

Industry Relations

A major objective of export development activities is to encourage and support private sector initiatives designed to increase exports of U.S. goods and services. In carrying out this objective, we have encouraged the formation of trade association international trade committees and multi-trade group export councils.

During the fall 1981 consultations leading to the joint industry/government renewable energy export development plan, industry representatives gave a high priority to the formation of an export council in the plan strategy.

In March 1982, eight trade associations and trade groups, representing the commercially viable renewable energy industry segments, formed the Export Council for Renewable Energy (ECRE). The Council serves as a focal point for the promotion and expansion of the industry's international trade activities. The Commerce Department welcomes the establishment of this independent industry body, and offers its cooperation, whenever possible, in implementing the Council's export promotion and export awareness objectives.

To supplement our efforts with the Export Council and individual trade associations, we are working closely with the trade publications serving the renewable energy sector. This provides an excellent marketing tool for reaching the new-to-export and new-to-market firms. Announcements and articles regarding the International Trade Administration's export promotion activities have been and will continue to be published in these trade journals and newsletters. This action encourages U.S. firms to contact the Commerce Department for further information.

International Trade Administration's Programs and Activities

The International Trade Administration has some 40 programs and services designed to assist individual U.S. firms by increasing their awareness of foreign market opportunities. Although too numerous to detail, Mr. Chairman, a representative listing of these export programs and services has been provided to the members and staff of the assembled subcommittees. (attachment 4)

I would like to focus today on those ITA programs and activities which have proven particularly successful in supporting private sector efforts to develop markets overseas and in promoting U.S. renewable energy exports. These programs and activities include:

1. The Certification Program
2. Domestic Export Awareness Seminars
3. Commercial News USA
4. Major Projects
5. Exhibitions and Trade Missions

The Department of Commerce certification program promotes a number of major domestic and overseas trade shows to potential foreign buyers through the efforts of the Foreign Commercial Service in diplomatic posts around the world.

This program was utilized to encourage business and public sector representatives from developed and developing countries to attend the Solar Technologies Conference and International Exposition, held June 1-5, 1982 in Houston, Texas. In appropriate countries, Foreign Commercial Service officers concentrated their promotional efforts on energy end-users, energy planners and marketing representatives of renewable energy and allied fields.

ITA's renewable energy industry specialists coordinated the Foreign Commercial Service post promotional efforts with the trade show sponsor and organizer, on behalf of the U.S. exhibiting firms. An International Visitors Center, operated by ITA's industry specialists, offered interpreter and other assistance to all foreign visitors. A directory of those exhibitors interested in export markets, listing product description and type of export interest, was distributed to all foreign visitors. Copies of this directory will be sent to all U.S. diplomatic posts for reference and distribution.

As a result of the Department's certification program over 200 foreign visitors (not including Canadians) were exposed to the latest U.S. renewable energy technology and products. The exposition organizer indicates that foreign buyers (including Canadians) constituted about 26 percent of total show attendance. Exhibiting firms attributed the success of the expostion to the large foreign attendance, and reported both off-the-floor sales and preliminary discussions regarding licensing agreements and joint ventures with many of the foreign buyers. The International Solar Energy Exhibition to be held in 1983 is also scheduled for foreign buyer support.

Domestic Export Awareness Activities

To develop awareness of the market opportunities for exports, ITA sponsors and organizes export awareness seminars. These are designed to inform U.S. firms of the necessary steps which must be taken in order to export their products. Firms which attend these seminars are provided with follow-up, individualized business counseling by the district office closest to them. In 1980 and 1981, six seminars were held for the renewable energy sector attracting about 250 firms.

Major Projects

The Office of Major Projects within Trade Development assists U.S. renewable energy firms through the dissemination of trade opportunities received from Foreign Commercial Service posts for solar and other renewable energy technology and equipment projects. In addition, Major Projects officers are in contact with Trade and Development Program (TDP) officials to discuss the possibilities of funding for renewable energy opportunities, as they arise.

Commercial News USA

The International Trade Administration publishes and distributes overseas a monthly magazine which promotes U.S. products and equipment. We published an exclusive issue of Commercial News USA in FY '81 on the U.S. renewable energy industry. The magazine contained articles on the state-of-the-art in all renewable energy fields, as well as individual U.S. company advertisements. This publication was distributed to over 240 U.S. diplomatic posts, translated into the language of the foreign country, and redistributed to the local business community. Through Commercial News USA a U.S. company has the potential to reach over 250,000 foreign business executives and government officials. The success of this issue has led us to schedule another exclusive issue for the renewable energy sector in December 1983.

Exhibitions and Trade Missions

Mr. Chairman, one of the most effective methods of promoting U.S. goods and services in foreign markets is through Commerce-organized trade exhibitions and missions.

Exhibitions include country and industry trade fairs, solo fairs, catalog shows and video catalog shows. Trade missions include officially-sponsored seminar missions and specialized trade missions, as well as industry-organized government-approved trade missions.

The International Trade Administration recognizes the importance of exhibitions and missions to high technology firms, including those in the renewable energy sector. Based on the successful trade events organized by the Department of Commerce and funded by the Department of Energy in FY '81, we are organizing four exhibitions and trade missions during the next 15 months exclusively for the renewable energy industry. These events include officially sponsored seminar trade missions to China, Thailand, the Philippines and Taiwan; a catalog show during the Cyprus Fair; and a major energy fair in Singapore. An additional fair in Venezuela and five trade missions featuring electric energy equipment are available for participation by the companies in this industry sector. In response to industry requests, the FY '84 plan proposes two trade fairs and five trade missions exclusively for renewable energy companies and an additional five trade missions for electric energy manufacturers suitable for the participation of many companies in the renewable energy sector.

Further Assistance for Export of Renewable Energy Technology

Exports of renewable energy technologies and devices should benefit considerably from enactment of Export Trading Company (ETC) legislation. The legislation, strongly supported by the Administration, seems almost made-to-order for this industrial sector. The ETC is specifically designed to encourage small- and medium-sized companies that do not presently export--a description that I believe characterizes most of the businesses in the renewable energy field--to band together in joint marketing activities along with banks or other large businesses with export know-how and financial resources to help defray risk. Using the ETC vehicle, renewable energy consulting services, systems and components could be "packaged" by an Export Trading Company with participation by a major architectural, consulting or construction firm and/or banks or insurance companies that might assist in financing major projects abroad.

A major feature of our plans for implementation of this legislation is a clearing house operation in which ITA will put prospective client firms and principals in touch with each other. Since I am personally responsible for getting implementation on track, I can guarantee that we will do everything in our power--using the U.S. and Foreign Commercial Services, trade associations, State development agencies and any other likely source of assistance--to see that firms engaged in renewable energy systems receive effective support and encouragement to participate in ETCs. our new Office of Service Industries is another key element in the effort to promote exports of renewable energy systems. That unit, charged with assisting consultants, engineers and other services firms to export, will seek to identify firms offering solar and other renewable energy services and help introduce them to suitable foreign markets.

Conclusion

Mr. Chairman, the Department of Commerce recognizes the significance of developing country markets to the U.S. renewable energy industry, as well as the potential benefit to those countries in the development of their renewable energy resources. U.S. renewable energy technology remains competitive, if not superior, to that of Japan and Europe. U.S. renewable energy firms have shown time and again an extraordinary interest in developing overseas markets. With the increased resources of the U.S. and Foreign Commercial Services, the proven success of its export promotion programs and activities, and the expertise of its country desk officers and industry specialists, ITA can provide these firms with the assistance that they need to commence or expand their exporting activities.

The success of the FY '81 Department of Energy/Department of Commerce renewable energy trade events and recent private sector initiatives, culminating in the formation of an industry export council, have led us to believe that the best way to increase renewable energy exports is through industry/government cooperation. I would like to take the opportunity of this hearing, Mr. Chairman, to further pledge our commitment to work with the Export Council for Renewable Energy to achieve the goal which we both share, i.e., development of export markets by U.S. renewable energy firms.

Wang# 3301s

PLAN OF ACTION

(to be revised by July 1982)

PROGRAM ACTIVITIES

FIRST QUARTER FY'82

DATE	TYPE OF ACTIVITY	LOCATION
	Initiate Joint DOC/SEIA exploration of means to alleviate financial burden of: 1) hosting the 1982 meeting of the International Standards Organization Technical Committee on Solar Energy (ISO/TC 180), and 2) the administrative operating costs of the ISO Subcommittee on Systems Testing chaired by the United States. This exploration effort should include contact with the American National Standards Institute, and industry firms.	Washington, D.C.
Nov. 1-4	Joint DOC/SEIA/SERI "Export Awareness" Seminar at Solar Energy Industries Ass'n Annual Meeting and Trade Show.	Las Vegas, NV

SECOND QUARTER FY'82

DATE	TYPE OF ACTIVITY	LOCATION
Jan 4-23	DOC-organized Trade Mission "Electrical Power."*	Egypt/Syria/ Algeria/Morocco
Feb 24-26	DOC-promoted/Market Launch "Euroclima Solar Energy/Heat Exchangers Exhibit."	Brussels, Belguim
March 15	Hold introductory meeting of the Renewable Energy Export Council.	Washington, D.C.

THIRD QUARTER FY'82

DATE	TYPE OF ACTIVITY	LOCATION
April 6-9	DOC-promoted "Energy '82" Fair.	Tokyo, Japan
May-Oct.	1982 World's Fair.	Knoxville, TN
May 24-28	DOC-promoted/Market Launch "EXPOCLIMA" Fair.	England
June 1-5	DOC Foreign Buyers Program-Supported American Section of the International Solar Energy Society (ISES) Annual Conference	Houston, TX
June 15-30	DOC-organized Seminar/Trade Mission "Electrical Power Equipment."*	Chile/Brazil/ Argentina/Paragua /Uruguay

*Includes conventional and non-conventional energy products/technology.

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THIRD QUARTER FY'82 (CONTINUED)

DATE	TYPE OF ACTIVITY	LOCATION
June	Providing that export trading company enabling legislation is passed by Congress and signed by the President, initiate SEIA/DOC discussions to: 1) arrange an export awareness campaign of export trading companies conducted by local DOC District Offices, and 2) explore the possibility of including export trading companies in DOC fee-paid export trading lists (categorized by technology, industry or product expertise).	Washington, D.C.
June	Initiate a survey of SEIA member firms to determine each firm's export capability and experience.	Washington, D.C.

FOURTH QUARTER FY'82

~~July~~ (see 1st Qtr FY'83)	DOC-organized Seminar Mission "Solar & Alternate Energy Sources." } postponed to Nov. 1982	Thailand/ Philippines/Tai ~~/Indonesia~~
August	Initiate drafting of U.S. Industry Profile on solar thermal or wind energy for dissemination to DOC U.S. Foreign Commercial Service and Dept. of State Foreign Service Officers overseas.	Washington, D.C.
September	Complete and summarize survey of export capability and experience of SEIA member firms. Forward to DOC list of those firms determined to be export capable for specialized counseling by DOC local District Offices.	Washington, D.C

*Includes conventional and non-conventional energy products/technology.

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FIRST QUARTER FY'83

DATE	TYPE OF ACTIVITY	LOCATION
October	DOC/SEIA-sponsored "Export Management Seminar."	San Francisco, CA.
November	Finalize U.S. Industry Profile on solar thermal or wind energy and disseminate to DOC U.S. Foreign Commercial and Dept. of State Foreign Service Officers overseas.	Washington, D.C.
November	DOC-organized seminar mission "Solar & Alternate Energy Sources."	Thailand/Taiwan/ Philippines

SECOND QUARTER FY'83

January	DOC-organized Trade Mission "Energy Saving Equipment and Products."	Japan/Hong Kong/ Korea
Jan.	DOC/SEIA-sponsored "Export Management Seminar."	Los Angeles, CA.
March	DOC-organized Seminar Mission "Electrical Power Generation."*	Zimbabwe/Zambia/ Kenya
	Initiate and complete video catalogue of renewable energy to show overseas.	Washington, D.C.

THIRD QUARTER FY'83

April	Industry-Organized, Government-Approved (IOGA) Trade Mission "Renewable Energy Technologies & Products."	Middle East (3-4 countries)
April	DOC-organized Seminar Mission "Electrical Energy."*	Turkey/Yugoslavi /Israel/Italy
May	DOC/SEIA-sponsored "Export Management Seminar."	Denver, CO
May	DOC-participation in Cyprus Fair DOC-sponsored Catalogue Exhibit at Fair on "Solar Energy Heating & Cooling."	Nicosia, Cyprus
June	DOC/SEIA-sponsored "Export Management Seminar."	Boston, MA

* Includes conventional and non-conventional energy products/technology.

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FOURTH QUARTER FY'83

DATE	TYPE OF ACTIVITY	LOCATION
July	Industry-Organized, Government-Approved Trade Mission on "Renewable Energy Technologies & Products" (to coincide with Hambury Fair in Germany).	W. Germany/ Denmark/ Scandanavia
July	Create by end of this Quarter a renewable energy trade newsletter, containing commercial leads, export events, and articles of interest to specific industry subsectors.	Washington, D.C.
Sept.	DOC/SEIA-sponsored "Export Management Seminar."	Miami, FL
	Publish by end of this Quarter an edition of DOC Commercial News USA exclusively devoted to renewable energy.	Washington, D.C.

FIRST QUARTER FY'84

(DOC overseas promotions not yet scheduled).

DATE	TYPE OF ACTIVITY	LOCATION
Oct.	Update U.S. Industry Profile on Photovoltaics.	Washington, D.C
Nov.	Initiate drafting of U.S. Industry Profile on a subsector of renewable energy for dissemination to DOC U.S. Foreign Commercial Service and Department of State Foreign Service Officers overseas.	Washington, D.C

SECOND QUARTER FY'84

DATE	TYPE OF ACTIVITY	LOCATION
Jan.	DOC/SEIA-sponsored "Export Management Seminar."	Phoenix, AZ
Feb.	Industry-Organized, Government-Approved Trade Mission on "Renewable Energy Technologies & Products" or Video-Catalogue Show.	Far East (3-4 countries)
March	Finalize U.S. Industry Profile on a subsector of renewable energy and disseminate to DOC U.S. Foreign Commerical and Dept. of State Foreign Service Officers overseas.	Washington, D.C

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THIRD QUARTER FY'84

DATE	TYPE OF ACTIVITY	LOCATION
April	DOC/SEIA-sponsored "Export Management Seminar."	New York, New York
May/June	Industry-Organized, Government-Approved Trade Mission on "Renewable Energy Technologies & Products" or Video-Catologue Show.	Southern Europe (3-4 countries)

FOURTH QUARTER FY'84

September	DOC/SEIA-sponsored "Export Management Seminar."	San Francisco, CA.
September	Industry-Organized, Government-Approved Trade Mission on "Renewable Energy Technologies & Products."	Mexico and Central America or Latin America (4 countries)

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I. Executive Summary

1 Definition of Industry Sector

The Renewable Energy Industries sector consists of three industry subsectors which are commercially viable and four industry subsectors in relatively early stages of research, development and demonstration. The titles of all seven subsectors and the major product categories of the commercially viable subsectors are listed below. (Please refer to Section II of this Export Development Plan for further information regarding product categories of those subsectors currently under research and development.)

A. Solar Thermal Energy

Major Product Categories

(1) Passive Systems

  (a) Prefabricated Components

  (b) Design/Contracting Services

(2) Active Systems

  (a) Collectors
    i) Low Temperative (less than 43 C)
    ii) Medium Temperature (43 - 82 C)
    iii) High Temperature (greater than 82 C)

  (b) Heat Transfer Apparatus, Pumps and Fans

  (c) Storage, Controls and Regulators

  (d) Electric Power Generators and Receiving Stations

  (e) Other Components

(3) Services (including engineering, installation and consulting).

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B. Photovoltaics

Major Product Categories

(1) Systems Components

  (a) Cells, Panels, and Arrays

  (b) Power Conditioning Devices (e.g., inverters, charge and discharge controllers, regulators, etc.)

  (c) Energy Storage Devices

(2) Panel Assemblies (DC power only)

(3) Panels and Inverters (AC power)

(4) Panels and Motors (rotory power)

(5) Power Packs (AC/DC power)

(6) Home Building Electrical Power Systems

(7) Community or Industrial Power Systems

(8) Packaged Products (i.e., system may include such enduse equipment as pumps, fans, refrigeration equipment, microwave telemetry, sensing and recording devices, etc.)

(9) Services (engineering, installation and consulting)

C. Wind Energy

Major Product Categories

(1) System Components

  (a) Wind Turbines, Shafts, and Gearboxes

  (b) Towers

  (c) Generators (AC/DC)

  (d) Power Conditioning Devices (e.g., inverters, controllers, etc.)

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(e) Energy Storage and Control Devices

(f) Measuring Instrumentation

(2) Mechanical Systems

(a) Water Pumping Systems

(b) Other Mechanical Applications

(3) Electrical Power Generation Systems

(a) Small Scale (less than 10 kilowatts output)

(b) Intermediate Scale (10-100 kilowatts output)

(c) Large Scale (100 kilowatt - several megawatt output)

(4) Services (construction, engineering and consulting

D. Biomass Energy

E. Low-Head Hydroelectric Power

F. Ocean Energy

G. Geothermal Energy

2. Status of Working Relationship

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Status of Working Relationship (cont'd)

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3. Analysis

3.1. General Conclusions

An analysis of the Renewable Energy Industries sector confirms that, with exception of sales of woodburning stoves and gasohol, the four subsectors in relatively early stages of development had limited or negligible domestic and export sales in 1979 and 1980. Close analysis of the three commercially viable Renewable Energy Industries subsectors indicates that, although moderate to rapid growth in both domestic and export sales has occurred during the past several years, domestic growth has been aided by government policies and financial incentives or support, and export growth has been basically attributable to increased sales by large corporations with international sales and distribution networks.

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The percentage of exporting firms within the combined three leading sector industries is greater than that estimated by the Department of Commerce for all U.S. industries. This suggests a shared assumption within the Solar Thermal Energy, Photovoltaics, and Wind Energy subsectors that expansion of their sales base through exporting can more rapidly achieve economies of scale, and thus reduce product costs and prices for both their domestic and export markets. This is an important consideration, given the currently lower prices for comparable renewable energy products set by their overseas competitors.

However, the analysis also uncovers sector-wide trends of high export sales concentrations and (with the exception of the photovoltaics industry) correspondingly low levels of export activity among the majority of commercially active renewable energy firms. This reflects the general composition of the combined three subsectors, i.e., predominantly small and medium-sized firms with limited resources concentrated mostly on local markets. Even in the relatively export-oriented photovoltaics industry, the more numerous smaller firms, accounting for the minority of total industry export sales, register a lower level of export activity than that of the few large companies active in the industry's export market.

Although U.S. manufacturers of renewable energy products and systems currently manintain a technological edge over those produced by foreign companies, a number of factors neutralize this competitive advantage and hamper increased export sales by U.S. firms. These barriers to increased exporting are:

(1) the lack of familiarity and experience of small and medium-sized renewable energy firms with exporting methods and mechanisms;

(2) the insufficient availability of information regarding major and potential overseas markets, including country-specific economic, financial and market conditions, insolation, wind and water resources, renewable energy import and design policies or regulations, current/projected energy use and development, and potential joint venture partners;

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(3) the lack of awareness of renewable energy technologies, products, and systems applications among potential exporting domestic end-user industries, foreign based end-user industries, U.S. government export development personnel, and foreign government officials;

(4) the lack of overseas marketing, distribution and "contacts" network in major market areas among the vast majority of renewable energy firms; and

(5) lower renewable energy product and system pricing by foreign competitors, resulting from higher U.S. shipping costs and foreign government financial support for both research and market development.

3.2 Overall Sector Export Performance

Eport sales by the Renewable Energy Industries sector increased by 57% from 1979 to 1980, reaching a level of $36.1 million. Broken down by subsector, Solar Thermal Energy accounted for 24% of total sector export sales, Photovoltaics accounted for 69%, and Wind Energy accounted for 3%. Supporting products and services from all subsectors account for the remaining 4% of export sales.

Export sales of renewable energy products, systems and related services are expected to continue to grow in 1981, but at a much slower rate than in 1980 (primarily as a result of recessionary conditions in Europe and the increased value of the dollar relative to other currencies).

Sector-wide export sales are heavily concentrated. Ten companies within the three commercially viable subsectors accounted for 70% of the value of total sector-wide export sales in 1979. The remaining 30% was distributed across 115 companies. Similarly, one fifth of the firms in the three leading renewable energy industries (solar heating and air conditioning active collector, photovoltaics and wind energy) accounted for approximately three fourths of their combined 1980 export sales by value.

Although the percentage of renewable energy firms within these three industries which entered the export market in 1980 (28%) is significantly higher than the average estimated by the U.S. Department of Commerce for all U.S. industry (10%), export sales by these firms represented only 14% of the value of their total (domestic and international) sales in that year.

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3.3 Solar Thermal Energy

The Solar Thermal Energy subsector consists of two separate industrial groups producing products or systems related in concept but differing in applications. The solar heating and air conditioning (SHAC) industries, comprised of 500-600 firms, along with an additional 7000 related service firms, constitute the largest of the two groups. This industry group is further divided into differing approaches towards solar applications (active vs. passive), several types of firms (systems design, manufacturing, marketing and service), and various end products (components, such as collectors, controls, etc., or total systems). Although a number of large companies operate within the SHAC industries, the majority of firms are small businesses operating on a local or regional basis with high labor content and low capital equipment/upfront financing.

The second industry group, collectively known as Solar Thermal Electric, is comprised of approximately 70 firms active primarily in research and development, and only secondarily in commercialization of energy systems for electricity generation and industrial heat process applications.

Total (domestic and international sales) of low-temperative collectors produced by the active SHAC industries reached $150 million in 1980, representing a 23% increase over 1979 sales. The annual rate of growth for these collectors during the period 1976 through 1980 averaged more than 40%. By comparison, sales of Solar Thermal Electric medium and high temperative collectors were very modest, reaching only a level of $20 million for trough concentrator collectors in 1980.

Export sales of all solar thermal energy products and systems in 1980 totaled $8.5 million, representing on increase of 37% over 1979 exports. Broken down by industrial group, SHAC export sales in 1980 of $7.4 million marked on increase of 45% over 1979 levels, while Solar Thermal Electric exports in 1980 remained unchanged from the level of $1.1 million recorded in 1979.

Export activities of passive SHAC equipment and products remained negligible in 1980. Sales of collectors and collector systems accounted for approximately two-thirds of all active SHAC products exported in 1980. The remaining one third was comprised of balance of system components, such as controls, storage tanks and pumps.

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The most active export markets for SHAC collector firms were Europe and Asia, which together accounted for 69% of their export sales. Australia/New Zealand, Canada, and the developing countries in Latin America, Africa and the Middle East accounted for the remaining 31%.

Export sales were highly concentrated among those active SHAC collector firms operating in the export market. Eleven of these firms, each with annual export sales greater than $1 million, accounted for 77% of total 1980 collector exports. The remaining 23% was distributed among fifty additional firms. An estimated range of between 76% to 83% of all active SHAC collector firms did not record any exports in 1980.

Significantly, the level of exporting activity was very low among even those firms which did record export sales in 1980 , with exports representing only 6% of the value of total sales of the leading eleven firms and only 1% of the value of total sales of the remaining 50 firms.

3.4 Photovoltaics

Although smaller in size and value of total sales than solar thermal energy, the photovoltaics (PV) industry is the largest exporting segment within the Renewable Energy Industries sector.

In addition to servicing the market for various outer space applications (including satelite communications) for which it was developed, the photovoltaics industry is pursuing markets for the use of cells, modules and systems in remote communications, cathodic protection, navigational aids, water pumping for irrigation , and various applications requiring small and moderate amounts of reliable power in remote areas.

The photovoltaics industry consists of approximately twenty companies producing cells, modules and systems, and between forty to fifty companies engaged in research, development and demonstration of PV products. Companies involved in these activities range from small, specialized firms to large corporations, and include subsidiaries or divisions of six major oil companies.

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In addition to differentiation based on type of activity, the industry is grouped by type of end product. While some firms produce only the photovoltaic cells and modules, other firms (known as Original Equipment Manufacturers or OEM's) just produce integrated systems for one or several applications, and still other firms produce an array of cells, modules and systems. An unusual aspect of this grouping is that OEM firms act as a direct market and an indirect marketing agent for producers of cells and modules.

Total (domestic and international) sales of PV cells, modules and systems (excluding space applications) reached a level of approximately $49 million in 1980, representing an increase of almost 69% over 1979 sales. This increase follows a trend recently established for photovoltaics of an annual sales growth rate of between 50%-70%.

Export sales of PV cells, modules and systems increased to approximately $25 million in 1980, representing a growth rate of 79% from the level of sales in 1979. Exports in 1980 assumed for the first time the dominant role in industry sales, constituting 51% of the value of total (domestic and international) sales.

PV firms producing cells, modules and/or systems accounted for 92% of total exports. The remaining 8% was attributed to sales of integrated systems by OEM firms. Cells and modules became the major PV products exported, with their portion of export sales growing from 45% in 1979 to 51% in 1980. (Conversely, sales of systems dropped to 49% of total industry exports in 1980.) This shift in type of end product exported was most pronounced among those small firms with limited export sales. Cells and modules accounted for 70% of the value of export sales recorded by these firms in 1980, up from 52% of sales recorded in 1979. This indicates an increasing industry trend of supplying cells and modules on a world-wide basis to systems integrators, rather than producing and marketing the higher valued integrated systems themselves.

Similar to other renewable energy industries, exporting activity by the photovoltaics industry is heavily concentrated. Export sales by the industry's three largest firms accounted for 76% of total 1980 exports. Eight other PV firms accounted for 17%, while OEM systems integrators accounted for the remaining 8%.

Europe was the primary market for photovoltaic products in 1980, accounting for over one half of the industry export sales. Other major markets included Asia and the developing countries in Latin America, Africa and the Middle East.

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3.5 Wind Energy

Despite the modest level of its current commecial activities, the Wind Energy subsector is projected to have considerable near-term growth potential.

Wind energy systems applications fall into two basic categories:
1) those using energy for mechanical functions, and 2) those using output for electricity generation. The immediate near-term potential for wind energy systems is in irrigation and other agricultural processes, cottage and other small-scale production, and small-scale non-grid electricity generation.

Out of approximately 50 companies which are direct producers of wind energy machines or systems, 4 firms manufacture mechanical systems, while 45 firms produce electrical systems (differing in scale of output capacity). The majority of electrical wind energy producers manufacture small-scale systems. Although most of the companies involved in wind energy are small, highly specialized firms, a number of large aerospace companies have become involved in the research, development and production of small, intermediate and large-scale electrical wind energy systems.

Total (domestic and international) sales of wind energy machines and related products or systems reached $19 million in 1980, representing an increase of almost 27% from 1979 sales levels. Electrical wind system accounted for 89% of 1980 sales, with mechanical systems accounting for the remaining 11% of sales.

With only $1 million in export sales, wind energy systems accounted for the smallest share of renewable energy exports in 1980. This represents a 9% decrease from wind energy export sales recorded in 1979. This sales decline reflects both the nature of wind energy industry exporting (i.e., limited to responding to inquiries generated through directory marketing lists or export agents), and the wider acceptance and greater attraction of other renewable energy products utilized in electric power generation in remote areas.

Significantly, only 5% of the value of total 1980 sales was attributable to exports, indicating a very low level of industry exporting activity.

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The industry, through its major trade association, proposes that the relationship it has developed over the past two years with the Commerce Department be formalized by the inclusion of renewable energy export promotion activities in the Department's export development programs, the establishment of an "umbrella" Export Council, composed of representatives from all of the renewable energy industries, -and the implementation of a comprehensive export development plan.

To counter the lack of awareness of renewable energy technologies and products, the industry recommends that: 1) a "primer" describing various commercially viable renewable energy technologies, products and systems be distributed in executive summary format to U.S. Foreign Commercial Service Officers overseas and Commerce Department local district office personnel; 2) a combined product catalogue/ industry profile be created and disseminated by local DOC district offices to major export oriented industry trade groups and by Foreign Commercial Service diplomatic posts to overseas trade associations, industry groups, leading businesses and government officials; 3) another edition of Commercial News USA exclusively devoted to renewable energy be published and distributed overseas.

To increase the number of renewable energy firms entering the export market, the industry suggests- increasing the number and effectiveness of export awareness seminars, surveying its membership to determine the export capabilities of member firms, and targeting these firms for specialized business counseling by the Department of Commerce district Offices. To meet the serious problem of availability of technical and market information, the industry seeks Commerce Department assistance in the maintenance of and continued access to the data base of the Solar Energy Research Institute, as well as additional market research to be identified by the industry and obtained by the Department of Commerce.

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Finally, the industry proposes to neutralize the price and marketing network competitive disadvantages, which hinder increased U.S. renewable energy exporting activities, by recommending the implementation of an export promotion campaign which would reduce the costs associated with marketing and facilitate the matching of U.S. firms with joint venture partners (who can provide needed financial and marketing expertise in developing countries). The key elements of this export promotion campaign are:

a) encouraging and facilitating greater industry participation in major Department of Commerce-sponsored and other overseas and domestic trade events (exhibits, shows, fairs and missions);

b) recommending for Commerce Department sponsorship and sponsoring its own Industry Organized Government Assisted trade missions to major and potential market areas (Europe, the Far East, North Africa and the Middle East, and Latin America;

c) creation of both a video and a printed catalogue of U.S. renewable energy products and systems applications for exhibiting and/or distribution overseas; and

d) the creation of a sector-wide industry newsletter to disseminate commercial leads, joint venture opportunities and other information important to the various exporting renewable energy industries.

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ATTACHMENT

A Representative Sample of ITA's Export Programs and Services

I. Trade Events

A. Exhibition Shows and Fairs

(1) Solo Fairs (staging an exhibition where no suitable trade fairs exists)

(2) Trade Shows (holding an exhibition in one of the U.S. Government's permanent facilities)

B. Missions

(1) Specialized Trade Missions (organizing business meetings for 6 to 12 U.S. firms in 2 to 3 countries)

(2) Seminar Missions (presenting "generic" discussions by 5 to 10 U.S. firms on U.S. technology in 2 to 3 countries)

(3) Industry-Organized, Government-Approved (IOGA) Trade Missions (supporting trade missions organized by U.S. trade associations, chamber of commerce, and state development agencies)

C. Special Exhibitions

(1) Catalog Exhibitions (displaying of the product catalogs, sales brochures, and other U.S. company graphic sales aids)

(2) Video/Catalog Exhibitions (showing video tapes of live product demonstrations along with product catalogs).

II. Export Awareness Activities

A. "How-to-Export" Seminars

B. Specialized Business Counseling by local U.S. Commercial Service District Offices

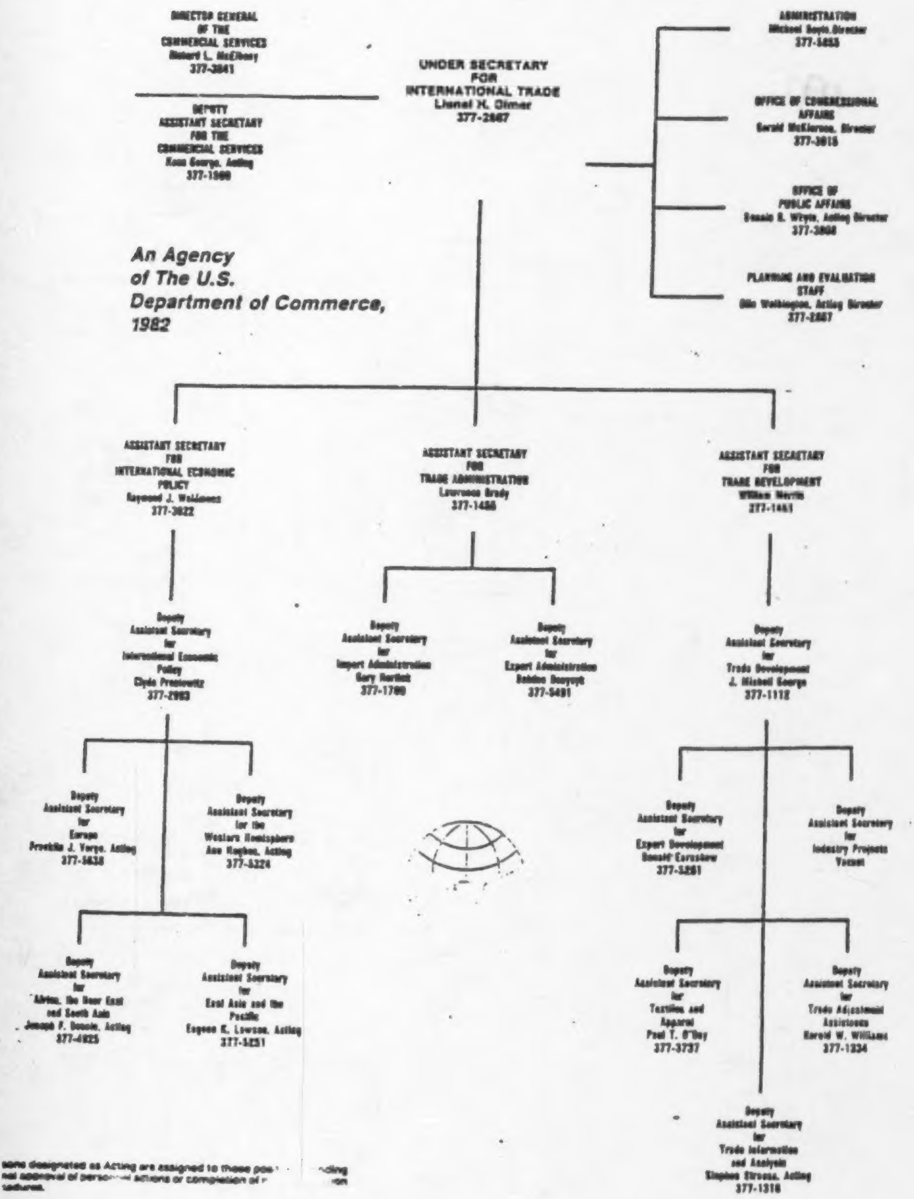
III. Market Research

- A. Department of Commerce-contracted research on specific major markets
- B. Information from Foreign Commercial Service Officers assigned to U.S. diplomatic posts overseas.

IV. Export Services

- A. Trade Opportunities Program
- B. Automated Information and Trade System (AITS) (computerized data bank)
- C. World Trader Data Reports (WTDR)
- D. Agent Distributor Service
- E. Commodity Trade Lists
- F. Commerical News USA publication
- G. New Product Information Service

International Trade Administration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1982

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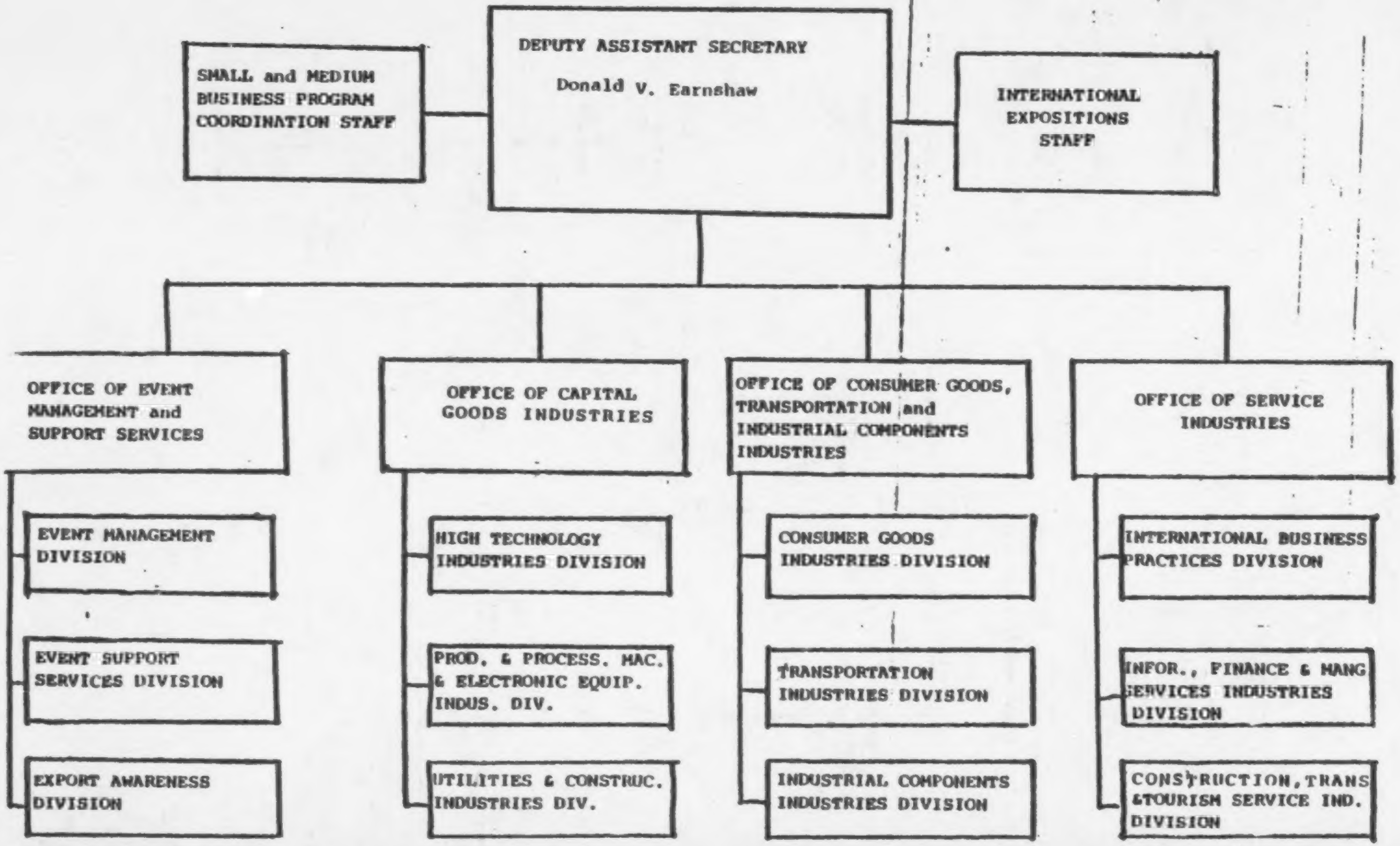
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OFFICE OF CAPITAL GOODS INDUSTRIES
HIGH TECHNOLOGY INDUSTRIES DIVISION
PROD. & PROCESS. MAC. & ELECTRONIC EQUIP. INDUS. DIV.
UTILITIES & CONSTRUC. INDUSTRIES DIV.
OFFICE OF CONSUMER GOODS, TRANSPORTATION and INDUSTRIAL COMPONENTS INDUSTRIES
CONSUMER GOODS INDUSTRIES DIVISION
TRANSPORTATION INDUSTRIES DIVISION
INDUSTRIAL COMPONENTS INDUSTRIES DIVISION
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INTERNATIONAL BUSINESS PRACTICES DIVISION
INFOR., FINANCE & MANG SERVICES INDUSTRIES DIVISION
CONSTRUCTION, TRANS &TOURISM SERVICE IND. DIVISION

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Mr. **Gore**. Thank you very much.

Mr. Bierman, last Thursday, Mr. Stingel testified. You are familiar with him, aren't you?

Mr. **Bierman**. Yes, sir.

Mr. **Gore**. He pointed out that, "In countries like England, France, Germany, and Japan, government financing is so nearly automatic that a deal is often made between suppliers and foreign buyers before contact is ever made with the supplier's government financing agency."

Would you agree with that characterization?

Mr. **Bierman**. To some extent, that is true.

The other export credit systems are quite predictable, and in large part a U.S. exporter, or an exporter can approach them very late in the game, so to speak, and obtain export credit assistance.

We have recognized that in the last 12 to 18 months at the Bank, and have taken steps to meet such competition when we know that the official export credit agencies in those countries would normally support their company on this export sale.

Mr. **Gore**. But you would agree that our foreign competitors have a substantial advantage in that regard.

Mr. **Bierman**. I am saying that their programs are somewhat predictable, and that the exporters in those countries can approach their governments at a very late date, knowing what terms and conditions will be supported.

Mr. **Gore**. Mr. Stingel also pointed out:

> Small- and medium-sized companies, particularly those selling technical components, are relegated to the bank's discount loan program or merely through insurance and guarantee coverage which results in uncompetitive commercial loan rates.

Is that the case?

Mr. **Bierman**. Beginning last October, we amended our discount loan program to have special emphasis on small manufacturers in the United States; that is, companies that we define as having annual sales of $25 million or less.

Under this particular program, we will provide 85 percent financing support for these particular companies' export sales today at a fixed interest rate of 12 percent.

This program is operated through the commercial banking community in the United States, and those banks are allowed to mark that 12 percent up by one point, which means the note to the end buyer is a 13-percent fixed rate, which is basically the same support that we give under your project lending programs today.

We have recognized the dilemma that a small manufacturer finds himself in and have attempted to adjust our programs to provide special incentives, both in the guarantees, insurance, and in the discount loan program for small manufacturers, and many are manufacturers of high-tech items and components.

Mr. **Gore**. Is that $25 million annual sales figure an appropriate one? How was that chosen?

Mr. **Bierman**. We feel that it is. We looked at our portfolio of business and the level of activity and budget levels that were allocated for this particular program, and we found about 20 percent of what we are doing under the discount loan program is being used by the small manufacturer, and, again, we continue to have an availability for companies that are larger than $25 million, but the special incentives were for that smaller group.

Mr. **Gore**. You have set aside some money for that group; is that right?

Mr. **Bierman**. What we have done is to, first, have a $400 million annual budget for the discount loan program. We have not set aside a particular part of that for small manufacturers. Approximately 20 percent of that particular program is being used by the small manufacturer, and our experience since October shows that.

The balance of 80 percent is being used by larger companies, companies with annual sales in excess of $25 million, and there is a 65-percent support program today at a fixed interest rate of 14 percent, but we have not allocated a specific amount for small manufacturers in the fiscal year 1982 budget figures.

Mr. **Gore**. Both Mr. Stingel and Mr. Heginbotham recommended a set-aside of a certain fraction up to $500 million for small- and medium-sized businesses.

You disagree with that recommendation?

Mr. **Bierman**. I disagree with a set-aside of Eximbank funds for any specific purpose. Once you begin allocating our funding, so much for this sector, and so much for that sector, we lose whatever flexibility we might have.

We are talking very actively with OMB, and within the bank, to make certain that the small- and the medium-sized manufacturers do get adequate support for their export sales.

Mr. **Gore**. How long have you been with the Eximbank?

Mr. **Bierman**. About 15 years.

Mr. **Gore**. Do you perceive an effort by this administration to wind down the Eximbank?

Mr. **Bierman**. Not at all.

What we have done in this administration is to look at using our resources more effectively and efficiently than maybe we have previously. We are attempting to support the most competitive cases where the French, the Germans, the British, Japanese and others are in sectors or in particular transactions in a very active way, and we will target our support to be as competitive as possible for those particular sales.

In the guarantee and insurance activity, which I personally oversee, we have seen, up to this point, no decrease in our budget authorities for those particular programs, and, in fact, have been able to support all exporters that have approached us for guaranteeing insurance support.

Mr. **Gore**. I am interested in a statement made in a letter from the president of Eximbank to the Congress in October of last year, and I quote from that letter:

> These figures dramatically indicate the conflict between the bank's two competing objectives. One is statutory and mandates the bank to offer financing which is competitive with the government-supported financing available to foreign exporters. The other is a long-standing policy that the bank should be a self-sustaining institution. It is impossible to do both in periods of high U.S. interest rates when our competitors insist on offering interest rates substantially below market rates.

Do you think that the statutory mandate overrides the long-standing policy referred to?

Mr. **Bierman**. Well, the long-standing policy also, Mr. Chairman, is supported by some degree of legislation. As I pointed out in my remarks, the bank's charter also instructs our board to set our loan rates, taking into account the cost of funds to the bank. The dilemma that Mr. Draper was talking about in his letter to the Congress——

Mr. **Gore**. Wait a second. What you have cited, you are not interpreting that as a mandate to be self-sustaining, are you?

Mr. **Bierman**. No, but I am interpreting it as a direction by the Congress to look at our cost of funds in establishing the interest rate that we charge on our loans to the foreign buyer.

Mr. **Gore**. In one case you have a mandate to do something, and in the other case, you have a mandate to take into account as one of many factors, the rate that you are charged for the money. So it would seem to me that the first mandate would take precedence over the second advisory injunction?

Mr. **Bierman**. You are correct, Mr. Chairman, and we have followed that particular mandate, attempting to be competitive to the detriment, if you will, of our financial situation.

As I pointed out in my remarks, we will be losing about $120 million this fiscal year.

Mr. **Gore**. But aren't you holding your rates at a level significantly higher than those of our competitors?

Mr. **Bierman**. Not significantly higher today.

They were some time ago, but there has been a very strong narrowing of the gap in the last 6 months.

Mr. **Gore**. Mr. Stingel testified that, "Most countries offer 85 percent cover after 15-percent cash payment and interest rates ranging from 10 percent to 11¼ percent. Eximbank by contrast insists on a flat 12-percent rate plus a 2-percent upfront one-time charge, and then attempts to hold loan cover at 65 percent."

Is that still accurate?

Mr. **Bierman**. That is still accurate today, but I would be hopeful that within the next 10 days or 2 weeks, there would be some change in that particular attitude.

What we have chosen to do, rather than to increase the subsidies from the United States, is to enter into very meaningful negotiations at high level with other export credit agencies and with other governments, to try to remove or reduce the subsidy element in the export area.

Effective as of last November, we got a marked increase in the interest rates supported by the other export credit countries to the rates quoted by Mr. Stingel, that is, from 10 to 11¼, when our rate was 12 percent.

We have been continuing to negotiate since that time to get those rates raised even higher, and, in fact, one of our senior vice presidents was in Paris last Friday again, discussing that particular problem with the other export credit agencies.

We are hopeful that within the next 2 weeks or so that we will have an agreement to recategorize countries, and to raise that 10 to 11¼-percent rate even higher, closer to the rates that are supported by Eximbank.

Mr. **Gore**. How long ago was this, that agreement to go up to 11¼?

Mr. **Bierman**. It became effective on November 16, 1981.

Mr. **Gore**. When?

Mr. **Bierman**. November 16, 1981.

Mr. **Gore**. I have here an article from the Asian Wall Street Journal about Canada. Presumably, it was in our Wall Street Journal, too.

It refers to a Canadian offer of subway cars with official financing at 9.75 percent. Are you familiar with that?

Mr. **Bierman**. Is that the MTA?

Mr. **Earnshaw**. New York City.

Mr. **Bierman**. MTA transaction. The Canadians allege that they offered that financing in order to meet French offering those terms.

What has happened——

Mr. **Gore**. Is it a violation of the agreement?

Mr. **Bierman**. In some situations—let me take a long way around and answer your question.

When an agreement is reached and a change is made in interest rates, there are certain transactions that have been negotiated previously under the prior terms and conditions that are grandfathered in on the old terms, and while I am not familiar with that case in detail, I would suspect that what happened was that the terms were negotiated prior to the new agreement coming into effect, so that the old terms and conditions could apply.

Mr. **Gore**. Well, Mr. Art Pine, writing for the Wall Street Journal, says,

> Washington contends that the Canadian offer which involves official export financing at a 9.75 interest rate violates a recently signed international agreement that sets minimum rates for such loans at 11.25 percent. Although the United States hasn't filed formal charges, Reagan administration officials told the Senate Finance Committee they would look favorably upon any complaints filed by U.S.-based companies hurt in the bidding competition.

Mr. **Bierman**. That issue is now being discussed in the Treasury Department, and they are due to make a decision fairly quickly on whether there was a derogation of the terms.

Mr. **Gore**. Now, has France also signed this?

Mr. **Bierman**. Yes, they have.

Mr. **Gore**. Well, so the complaint by Canada that they were just countering the French offer——

Mr. **Bierman**. One point, the possibility of grandfathering previous commitments; and, two, the fact that our Treasury Department is reviewing all of the documentation pertaining to that case, to see if there was a violation of the agreement, and they have not reached a decision on that.

Mr. **Gore**. What about the difference between 85-percent cover and 65-percent cover. Is that significant?

Mr. **Bierman**. In some cases it may be, Mr. Chairman, and what we have done in those particular areas where we feel that 85 percent financing may be appropriate in order to meet competition is to allow the U.S. exporter to raise 10 percent at our interest rate; that is, 12 percent today, and we would then raise our 65 percent to 75 percent cover, giving an 85-percent support program for the export sale, which would be competitive, then, with that offered by the other export credit agencies.

We do have a vehicle to get to 85-percent support.

Mr. **Gore**. Well, the effort to get agreements fixing the terms of financing so the different governments essentially have to offer the same packages is one that I am interested in.

It seems like a good approach, since we are apparently the only ones who are not competing.

Do you think that the agreements that have been arrived at thus far are generally being adhered to? Is this alleged violation the exception? Or is it quite common for the countries that have signed these agreements to cheat on them?

Mr. **Bierman**. I think that if that is a violation, it is very much of an exception.

Mr. **Gore**. OK.

Mr. **Bierman**. The other agencies do adhere to the agreements, once they are entered into.

Mr. **Gore**. Do you have any indication that other countries are circumventing agreements by using credit on private letterheads and having the Government indirectly subsidize the private lender?

Mr. **Bierman**. Not that I am aware of, Mr. Chairman.

Mr. **Gore**. Mr. Earnshaw, you mentioned a special edition of the Commercial News USA.

Would you supply that for the record?

Mr. **Earnshaw**. Certainly.

[The information follows:]

LETTER FROM THE EDITOR

New Renewable Energy Technologies and Products

As fossil fuel prices increase, worldwide interest in alternative fuel sources also increases, along with a concern for the dwindling fossil fuel reserves of our planet. Many nations are currently seeking information on new products which can effectively utilize these renewable energy resources to meet their energy demands. In a joint effort to promote and accelerate the widespread acceptance of renewable energy products and to increase U.S. exports, the Office of Export Marketing Assistance, International Trade Administration, U.S. Department of Commerce, and the International Market Development Program, U.S. Department of Energy, are pleased to present this issue of COMMERCIAL NEWS USA, highlighting new renewable energy products available for export that have been developed and manufactured by U.S. companies.

This is the third special Energy Issue of COMMERCIAL NEWS USA, a theme which has proven to be very successful in both the March/April 1977 and July/August 1978 issues. New products featured in this issue have been selected from OEMA's New Product Information Service (NPIS), which promotes the export of new U.S. manufactured products. More than 100 new products are described, representing such renewable energy technologies as wind, biomass, solar, etc., and articles on the latest developments in these technologies, calendars of events, both in the U.S. and overseas, and listings of informative publications are also included.

The Department of Commerce is co-sponsoring this publication as part of the numerous activities conducted by its Office of Export Marketing Assistance (OEMA) to stimulate export marketing in all segments of the U.S. economy. These activities include the development of promotional activities to increase U.S. industry's awareness of the potentials and benefits gained through exporting. OEMA has a close working relationship with U.S. industry in the development of long-term plans for export expansion. In this role, OEMA acts as a liaison between the Department of Commerce and industry to assure that industry's viewpoints are given full consideration in Departmental planning. Through its publication dissemination activities, OEMA provides U.S. companies with information on commercial participants in world trade and, in addition, prepares export marketing studies and informative brochures and pamphlets addressing all aspects of exporting.

The overall goal of the International Market Development Program (IMD), Department of Energy, is to increase the use of U.S. energy efficient and renewable energy products in international markets, to promote a more efficient use of energy, and to substitute alternative energies for depleting resources. To achieve this goal, IMD has developed programs to provide U.S. industry with a base from which exports of U.S. renewable energy products can be expanded. These programs include the dissemination of foreign market information and analyses developed for U.S. industry which identify and, therefore, stimulate export opportunities. In addition, potential joint ventures and licensing arrangements are explored for renewable energy products, and information on the international financial institutions and their financing methods is provided. With industry cooperation, IMD is promoting the adoption of product standards which would effectively increase the competitive edge of U.S. renewable energy products in the international marketplace. Following the foreign market assessments, the program will implement specific international projects utilizing U.S. supplied renewable energy products to promote the rapid penetration of foreign markets.

To insure that the new product information in this magazine reaches the greatest number of key industry and foreign government officials, the Department of Commerce and the Department of Energy urge the commercial officers at overseas posts to publish as many of these products as possible in their commercial newsletters. The success of the previous two energy issues can be attributed in large part to the enthusiastic support shown by the overseas commercial posts. With your continued support, this renewable energy issue will be even more successful than its predecessors. In disseminating this information worldwide, the United States is not only meeting a growing market demand for reliable and efficient renewable energy products, but is also contributing a positive, alternative approach to utilizing the Earth's energy supplies.

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TECHNOLOGY STATUS

The following articles (except for Ocean Energy Systems) were prepared for this issue by Systems Consultants Inc. The article on Ocean Energy Systems was prepared by the Office of the Assistant Secretary for Conservation and Solar Energy, U.S. Department of Energy, Washington, D.C.

SOLAR THERMAL

Applications

Solar thermal systems can provide hot water or hot air in domestic, agricultural, and industrial process applications. Agricultural applications include the use of solar for specific agricultural tasks, such as drying grains and pulp, and food processing industries requiring low temperatures. Potable hot water and solar cooking are potential domestic applications. Other applications include the use of solar thermal energy for desalination and refrigeration (See Figures 1, 2, and 3).

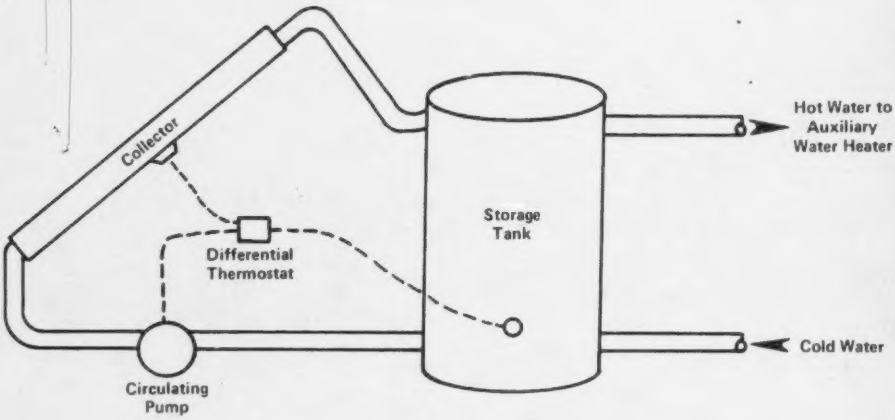
Collector
Differential Thermostat
Storage Tank
Hot Water to Auxiliary Water Heater
Cold Water
Circulating Pump

Figure 1. A Typical Residential Solar Hot Water System

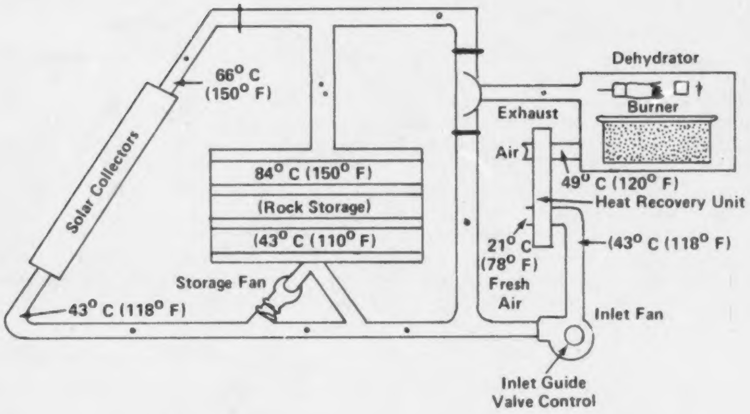
Dehydrator
Burner
66° C
(150° F)
Exhaust
Air
Solar Collectors
84° C (150° F)
49° C (120° F)
(Rock Storage)
Heat Recovery Unit
(43° C (110° F)
21° C
(78° F)
Fresh
Air
(43° C (118° F)
Storage Fan
43° C (118° F)
Inlet Fan
Inlet Guide
Valve Control

Figure 2. A Solarized Dehydrator Used for Drying Raisins and Prunes

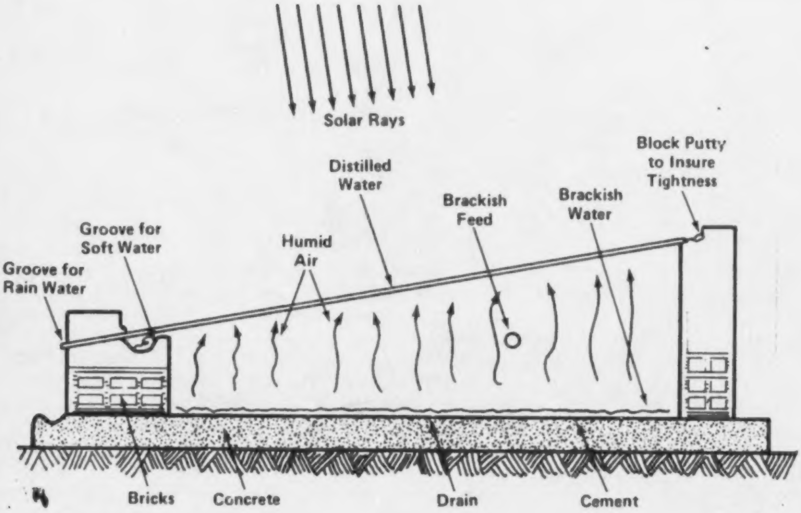
Solar Rays
Block Putty
to Insure
Tightness
Distilled
Water
Brackish
Feed
Brackish
Water
Groove for
Soft Water
Humid
Air
Groove for
Rain Water
Bricks
Concrete
Drain
Cement

Figure 3. Schematic Cross Section of a Basin-Type Still

Technology Status

Flat plate collectors can supply heat up to a temperature of 93° C, while evacuated tube collectors can reach approximately 177° C. Solar shallow ponds can also be used in the low temperature range. In the temperature range required by solar thermal applications, the technology is commercially available. Flat plate and evacuated tube collectors have been commercialized and are penetrating the United States residential and commercial building heating market. Thousands of hot water systems are in use in Israel, Australia, Japan, and the United States, and experience indicates that solar hot water systems are as reliable as conventional hot water systems. The U.S. industry produces solar systems and components and many collector manufacturers are developing low cost, more efficient collectors. Many of the system components for agricultural and industrial process applications are adaptations of heating and cooling components for buildings and, thus, utilize most of the same industrial base.

Cost

The cost of solar thermal systems is dependent on the particular application. System equipment costs for some typical applications are listed below. These costs are presented on a square meter of collector area basis.

Domestic Hot Water	\$177 - \$366/m^2
Solar Cooling	\$333 - \$500/m^2
Industrial Process Hot Air/Water	\$200 - \$400/m^2
Industrial Process Steam	\$377 - \$666/m^2

The cost of general construction/site preparation, shipping, testing, and checkout will be dependent on application size and location.

SOLAR THERMAL POWER SYSTEMS

Applications

Solar thermal power systems considered appropriate for most developing countries are small power systems under 10 MWe (100 MBtu/h). These systems, located close to consumers, can generate thermal energy to meet the needs of small communities, remote installations, and mid-temperature industrial processes. Systems can be designed with the flexibility to provide mechanical, electrical, or heat output as required. The modular nature of the technology permits sizing of systems to meet the particular application needs by specifying the number of modules necessary to meet a given power requirement. The thermal energy produced by solar thermal power systems can be applied directly to industrial applications or space heating, or it can be converted into electrical or mechanical power. Total energy systems can be constructed to provide heat and electrical or mechanical power. Small thermal power systems have great potential for powering irrigation projects and for electrification of remote villages (See Figure 4).

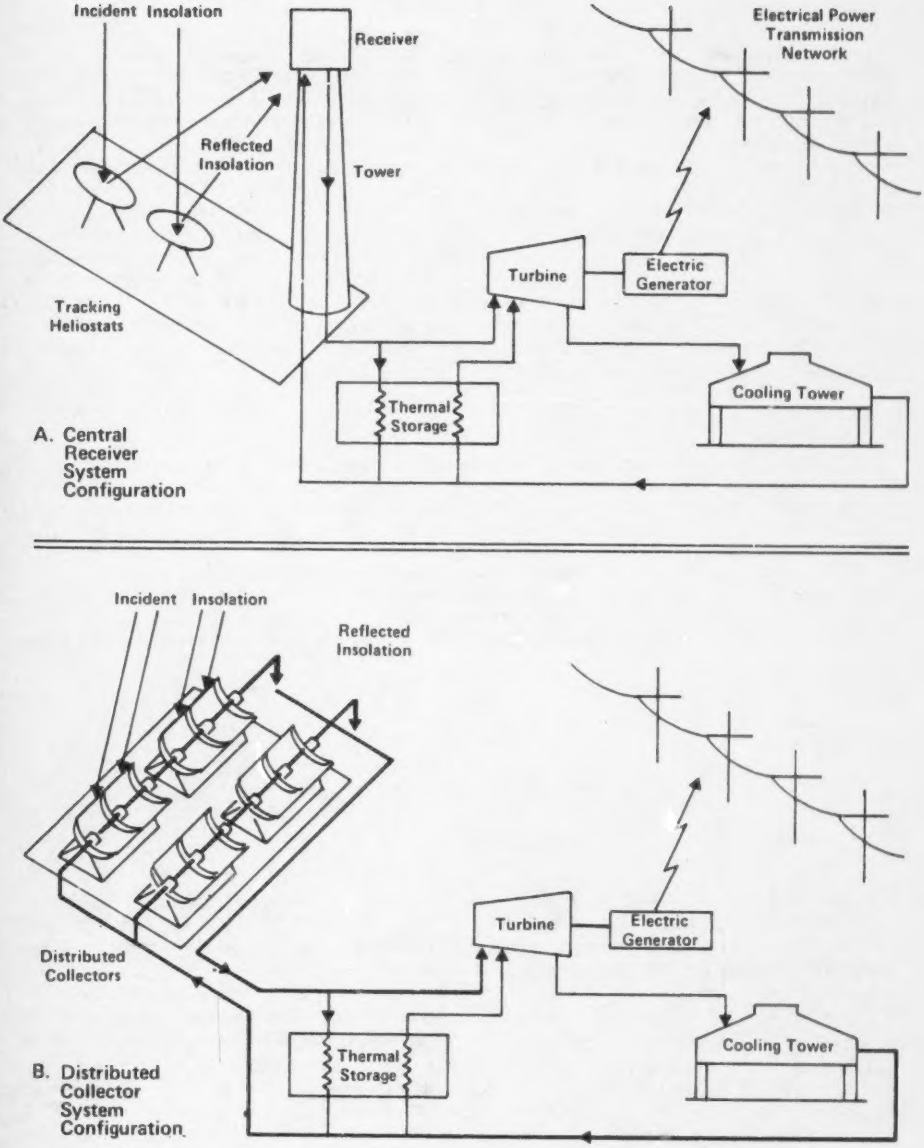
Incident Insolation
Receiver
Electrical Power Transmission Network
Reflected Insolation
Tower
Tracking Heliostats
Turbine
Electric Generator
Thermal Storage
Cooling Tower
A. Central Receiver System Configuration
Incident Insolation
Reflected Insolation
Distributed Collectors
Turbine
Electric Generator
Thermal Storage
Cooling Tower
B. Distributed Collector System Configuration

Figure 4. Solar Thermal Power System Configuration

Technology Status

Solar thermal power systems are comprised of a combination of thermal collectors, heat exchangers, and thermal engines which are assembled from common construction materials through conventional manufacturing techniques. As a result of active R&D programs in solar thermal power technology in the United States, Europe, and Japan, several small scale systems have been installed for irrigation pumping, air conditioning, and power generation applications. The systems which are in the most advanced development at this time, by virtue of their use in several demonstration projects in the United States, are those using parabolic trough collectors and organic Rankine cycle engines. The collector technology for small power systems is relatively well advanced, particularly for parabolic trough collectors. These collectors are commercially available from many U.S. and foreign firms and are being utilized in many projects. A test facility has established the technical performance of 15 to 18 different types of U.S. manufactured trough collectors. Somewhat less developed are parabolic dish collectors and, at the present time, only one commercial dish operating in the required temperature range is available.

Cost

To date, there has been very limited experience with establishing the commercial cost of solar thermal power systems. Costs are best established for the parabolic trough/organic Rankine cycle engine combination. Manufacturers project that the cost of parabolic trough collectors might approach $\$100/m^2$ in production quantities. The cost of organic Rankine cycle engines is expected to be in the $500 to $1,000 per kW range depending on capacity. The resultant system cost on an installed basis is in the range of $2,000 to $4,000 per peak kW of shaft output. The installation costs are significant and the most difficult to estimate due to variations in labor costs and site preparation. The current price of a parabolic dish collector is approximately $\$280/m^2$.

BIOMASS

Applications

The two most practical ways of utilizing biomass as an energy resource are direct combustion and digestion. Direct combustion of agricultural residues and urban wastes can be used to provide process heat and/or to retrofit coal or oil-fired power units. Residential applications of direct combustion include space heating, cooking, and water heating. Biomass can be used in conventional incinerator/boiler systems and can provide the steam used for generation of electric power. Such systems are currently used in large cities of industrialized countries for disposal of municipal solid wastes, and in conjunction with pulp and paper facilities where large quantities of wood residues are available as part of normal operations. Agricultural residues and animal droppings can be used as feedstock for an anaerobic digestor where the decomposition of organic materials results in a gas mixture of carbon dioxide and methane. This gas can be used to operate gas stoves or to operate a modified internal combustion engine/generator. The three currently available proven technologies - process steam production, electric power generation, and anaerobic digestion of residues to produce methane gas - are the most economically feasible biomass conversion possibilities (See Figure 5).

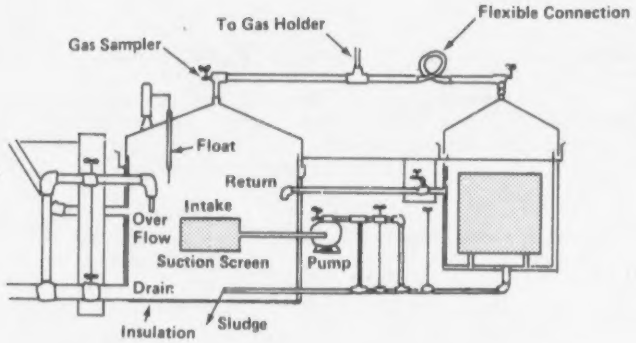

Figure 5. Gas Generating Plant for Vegetable Wastes

Technology Status

Many processing options can be applied to the conversion of biomass to energy. These processes range in their stage of development from laboratory scale to commercially proven processes. Commercial combustion facilities have been used for many years, and anaerobic digestion facilities for feedlot manures have been developed in the United States. Combustion is an efficient method of using the direct energy potential of biomass. Thermal efficiency is limited by the heat recovery equipment after the combustion chamber. Theoretically, thermal efficiencies, as high as 85 percent, can be achieved for direct-fired furnaces and steam boilers. Generally, biomass with moisture content below 30 percent can be combusted directly. Biomass with higher moisture content may have to be predried or fired with supplementary fuel, requiring expenditure of additional energy. However, a new technology, fluidized bed combustion, has the capability for efficiently burning wet residues. The overall direct combustion efficiency of biomass used to produce electricity is 20 to 30 percent depending upon feedstock, moisture content, ash content, and plant design. The direct combustion process is well established, and many coal or oil-fired units can be converted to burn wood or other biomass, provided uniform biomass feeds are provided. The hardware for direct combustion systems is available from U.S. dealers.

The operation of digester units for both family and small village use has been demonstrated using a variety of feedstocks. The process is commonly applied as a waste treatment for removing organics and producing methane from domestic and industrial wastes. The process takes place at low temperatures (up to 65° C) and requires a moisture content of 80 percent or more. Product gases consisting mainly of methane and carbon dioxide can be burned directly or can be upgraded to Synthetic Natural Gas (SNG) by removing the carbon dioxide and other impurities. There are several design options associated with a biomass digester system. The digester tank may be built of steel or concrete, and the gas produced stored in an inverted steel tank over the digester in a floating top storage, or the gas can be compressed and stored in a small pressure tank. The biomass can also be mixed periodically by an agitator within the digester to speed gas production. Many family-size to farm-scale biogas generating plants are in operation throughout the world. Small family-size digesters are usually fabricated in-country but none are currently being manufactured in the United States. Development of digester systems in the United States has been in dairy farm and feedlot-size systems designed for the U.S. market.

Cost

Incinerator/steam turbine systems from sizes 1 to 10 MW make the most economic use of construction materials such as steel and cement, but their demand for large quantities of biomass limits their feasibility to areas of concentrated biomass availability. Typically, these installed systems cost $30,000/t of refuse burned daily. Their present use in urban areas, as part of disposing of municipal solid wastes and sewage, indicates that the combined power generation disposal process can be made economically attractive.

Based on a 3 million SCF per day anaerobic digester plant producing SNG from manures, conversions costs are currently $2.00 per million Btu. System costs for small village size digesters are estimated at $\$90\ /\text{m}^3$ of digester volume.

PHOTOVOLTAIC

Applications

Photovoltaic systems can provide power in remote areas where conventional alternatives are expensive. The equipment is ideally suited for areas where no utility grid is available and where labor for installation is relatively inexpensive. The modular nature of photovoltaic equipment has an additional advantage of allowing functioning power sources to be installed quickly and in sizes appropriate for each application. Specific applications include irrigation and other water pumping applications, refrigeration, lighting, and communications (See Figure 6).

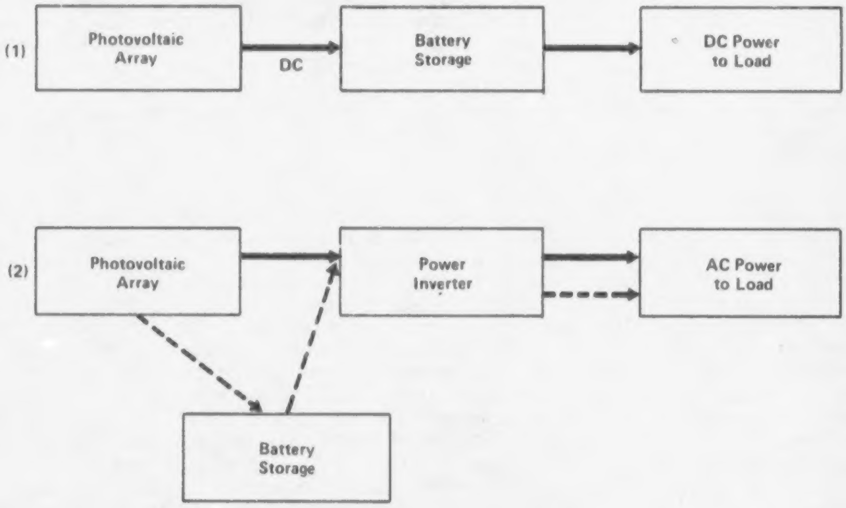

Figure 6. Block Diagram of Photovoltaic System

Technology Status

Most solar cell panels now utilize single crystal silicon due to its demonstrated high reliability, long life, and relatively high efficiency. It is expected that in the near to intermediate terms most solar cells will continue to be made from single crystal silicon, using steadily improved material purification and cell fabrication techniques to lower costs. The cells are assembled into panels which typically measure 60 to 120 cm. The output voltages of the panels are generally 12 to 24 V. The efficiency of individual cells in converting solar energy into electricity is typically 11 to 15 percent; however, when the packing density of cells within a panel and resistance losses are taken into account, the efficiency of panels is in the order of 10 percent.

Alternative materials to single crystal silicon, which are furthest along in their development, are gallium arsenide, cadmium sulfide, and amorphous silicon. The incentive for developing these alternatives is that they can be effectively utilized in very thin films which results in lowering the manufacturing cost. Although there are numerous R&D programs sponsored by both government and industrial organizations to improve the performance of these materials, none is sufficiently far advanced to have significant influence before 1985.

Hundreds of photovoltaic systems have been sold by U.S. industry and are operational throughout the world in a wide variety of climates. These systems, ranging in size up to 25 kW, are commercially available.

Cost

The costs associated with a photovoltaic system can be broken down into four major areas: Solar cell array, power conditioning equipment, battery storage, and electrical/mechanical installation. Current solar cell panel costs in large quantities are in the $12 - $18 peak watt range. These costs are expected to decrease to $4 per peak watt in the early 1980's and to $0.50 per peak watt by 1990. The cost of power conditioning equipment for investers in the 10 kW range is approximately $200 to $1,200 per kW, when purchased in small quantities. As production capacity of investors increase, their costs are expected to be in a $100 to $200 per kW range. Lead-acid batteries are currently being manufactured in modest production quantities for industrial application at a cost of about $75 /kWh. The cost is not expected to decrease dramatically as production capacities increase. However, new battery technology currently under development, if successful, may result in battery costs of $30 to $35 /kWh by the year 2000. The costs associated with installation of a photovoltaic system are not expected to decrease in future years, due to labor intensive manufacturing costs. Mechanical installation costs are currently estimated to be $22 to $44 /m^2 of collector area, while electrical installation costs are estimated to be $100 /kW.

Since specific applications will have different requirements for battery storage and power conditioning, system costs will depend significantly on the need for these subsystems, as well as the cost of the solar cell panels.

WIND ENERGY POWER GENERATION

Applications

The mechanical output of a wind system can be used for water pumping, grain grinding, or as a power source for mechanically driven equipment. The mechanical output can be converted to electricity to provide electrical power for rural homesteads and remote communities. The electrical power can be fed directly to residences, farms, or industrial facilities and can also be stored in batteries, if energy storage is essential. Wind systems of 4 to 8 kW output are appropriate for individual households, while systems up to 100 kW are suited for small community power needs or for large agricultural/ industrial use (See Figure 7).

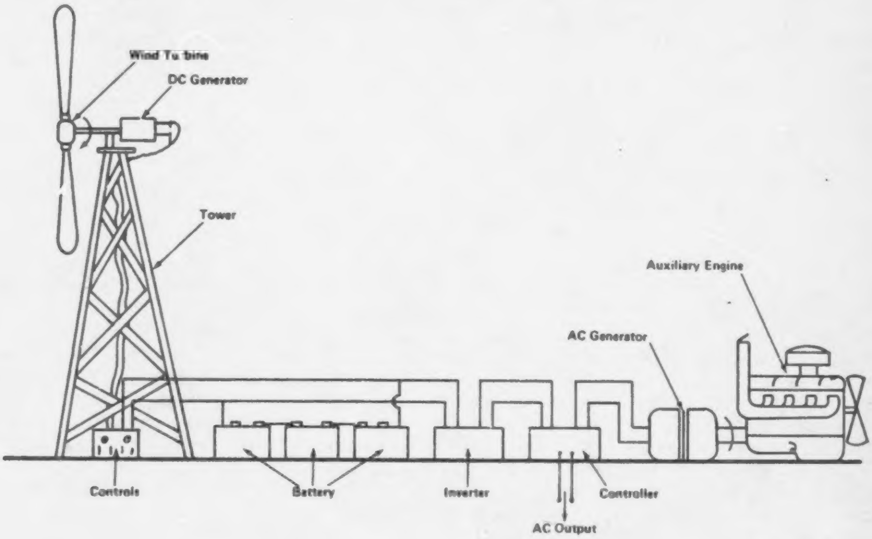

Figure 7. Schematic of a Wind Power System

Technology Status

The most common and furthest developed wind power generator is the conventional horizontal axis wind turbine. Two size ranges of wind power units are currently being manufactured or under development. Small units, with rated outputs in the 1 to 15 kW range, are now used to produce power in remote areas which are not serviced by a utility and where it would be expensive to operate small diesel generators. Various designs for these small systems have been devloped including multi-bladed, low speed, high torque configurations for water pumping applications. For electric power generation, high speed wind turbines are usually utilized. Commercially available units usually have 2 or 3 blades with diameters in the 1.5 to 8 m range and generally operate between 100 and 300 rpm.

Large units with outputs in the 100 to 5,000 kW range are under development in the United States for generating large amounts of power to supplement conventional utility systems. Several systems in the 100 to 200 kW range are in operation and undergoing performance testing. Although there has been some interest in vertical axis machines, virtually all large scale power systems being proposed today are of the horizontal axis type.

Cost

Currently there are a wide variety of commercial wind systems available from many United States manufacturers. The current U.S. market price for small units in the 6 kW range is $2,800 /kW. This includes site preparation, installation, and testing as well as component cost. A 25 percent reduction in price is anticipated with higher production levels.

Based on studies of utility sized systems produced in small quantities, cost for a large system in the 100 kW range is estimated to be $2,300 /kW.

LOW-HEAD HYDRO

Applications

Low-head hydro power plants can be used to provide shaft power or electricity. It is a technology which can be useful to developing countries for long-term applications. Systems can be used for farms, small industries and shops, and individual homes. Low-head hydro can provide electricity to small communities in rural areas not served by electrical energy. Although turbines may be coupled to drive pumps and machinery directly, the application with the most potential is the generation of electricity. Electrical plants can be used in off-grid or grid-connected situations (See Figure 8).

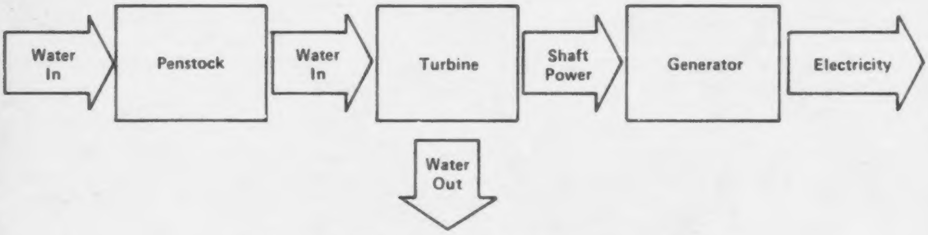

Figure 8. A General Schematic of a Hydroelectric System

Technology Status

Low-head hydro systems consist of heads from 2.4 to 15 m and, relying on larger flows of water, can produce as much as 5,000 kW per unit. Historically, there have been two major disadvantages with low-head hydro electric power generation. The large variations in water flow adversely affected the performance of the turbine, and the high discharge rate relative to the power output resulted in a high capital cost. However, the development of variable pitch turbine blades and axial flow-oriented turbines have alleviated these problems. The advent of standardized units for low-head applications has further reduced their cost. European countries provide stiff competition to U.S. manufacturers, especially since European countries have more operating and manufacturing experience in low-head applications. The standardization efforts of U.S. manufacturers and the U.S. Department of Energy's low-head hydro program aim specifically at improving the economics of low-head hydroelectric projects.

Cost

Low-head hydro systems, both electrical and mechanical, can be quite economical where a dam or diversion already exists for irrigation, flood control, water supply, recreation, or other purposes. Generally, a simple and inexpensive diversion will suffice to provide water for satisfactory turbine operation. The cost for a low-head hydro configuration is between $1.10 and $1.50 per peak watt. This cost estimate includes turbine, generator, and transformers, but does not include civil works, transmission lines, or distribution system.

OCEAN ENERGY SYSTEMS

Ocean energy systems have the potential for providing a renewable energy source for generating substantial amounts of baseload electricity and energy-intensive products. The potential resource extractable from U.S. waters using ocean energy systems is tens of quads per year. Systems currently under development include ocean thermal energy conversion (OTEC), wave energy, ocean currents, and salinity gradients. The latter three concepts are in the early development stage.

The OTEC concept is based on the use of ocean temperature differences between warm surface waters and cold water from the depths to operate a heat cycle that generates electricity. Two power cycles applying this concept are the closed cycle, utilizing a fluid with low boiling point such as ammonia; and the open cycle, using seawater is the working fluid. The following figure is a schematic diagram of the closed cycle (See Figure 9).

Hardware for the closed-cycle concept is closer to commercial availability than the hardware for the open cycle. Two ocean energy applications involve (1) moored platforms that supply electricity by submarine cable to shore and (2) floating platforms that "graze" for optimum temperature differences while generating electricity for onboard manufacturing of energy-intensive products.

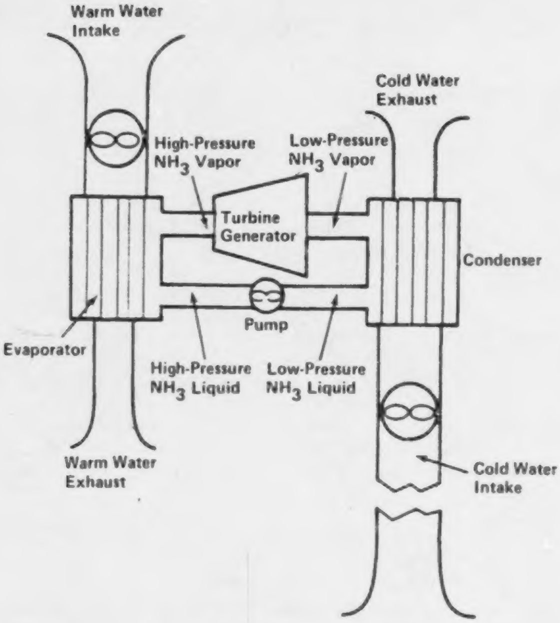
Warm Water Intake
Cold Water Exhaust
High-Pressure NH_3 Vapor
Low-Pressure NH_3 Vapor
Turbine Generator
Condenser
Pump
Evaporator
High-Pressure NH_3 Liquid
Low-Pressure NH_3 Liquid
Warm Water Exhaust
Cold Water Intake

Figure 9. Closed-Cycle Ocean Thermal Energy Conversion Concept

Wave energy systems convert mechanical energy from ocean waves to electricity. Recent concepts that focus wave energy and appear to offer potential cost effective advantages over other wave conversion systems have been proposed. Ocean current energy can be extracted by large diameter hydroturbines suspended below the surface and driven by the current. Power may be produced from salinity gradients by using the energy potential across a selective membrane between two solutions of differing salinity. One approach uses seawater for the saline solution and freshwater for the lower concentration solution. Alternatively, brine from salt domes may be used for the saline solution and seawater as the low salinity source.

MEETING INTERNATIONAL NEEDS FOR RENEWABLE ENERGY RESOURCES

This article was prepared specifically for this Renewable Energy Issue of COMMERCIAL NEWS USA by Dr. David Christensen of the University of Alabama in Huntsville, Alabama.

As fossil fuel prices climb, widespread interest in renewable energy resources and technology is likewise expanding at a rapid rate. This worldwide interest in solar and wind energy conversion, broader use of feedstock available from plant materials and wastes, and energy conservation is reflected by the large number of new products now becoming available. American manufacturers are producing a large variety of components and systems and providing numerous technical services to help ensure that renewable energy resources help to meet an increasing share of U.S. and international energy needs.

Photovoltaic solar cell devices that convert sunlight directly into electricity, with no moving parts and requiring no heating processes, are currently being exported. Modular solar arrays can be assembled to produce power ranging from a few tens of watts to many kilowatts. Cost-reduction goals are being met, and by 1986 it is expected that the cost for ready-to-install panels will be competitive with costs of electricity generated by using petroleum products. These systems are particularly adaptable to providing refrigeration and communication power to remote areas where conventional electric power is not available or is extremely expensive.

Wood, man's oldest fuel, is being evaluated and more widely used. The U.S. pulp and paper industry now produces half of its power by burning available wood wastes. Homeowners save money by using wood burning stoves, and utilities are studying plans to generate electricity by using wood instead of coal.

Conversion equipment for a variety of organic or plant materials is available, which can provide oil, heat, steam, alcohol, electricity, methane and other fuels. Many new types of crops and feedstocks are now being considered in order to expand the available resources of solid, liquid, or gaseous biomass-derived fuels.

Wind energy has been used for centuries in all parts of the world, and American manufacturers are bringing the prices of wind machinery down, and improving its reliability and efficiency. In the United States large wind conversion units to provide electrical power in conjunction with electrical grids are being demonstrated. Smaller wind power generators are available for rural areas.

Direct conversion of solar energy to hot air, hot water, steam, and other working fluids has been widely demonstrated in the United States. A viable industry, comprising designer, component manufacturers, test facilities, system packagers and installers, and marketing organizations has been established. These simple systems are easy to ship and install, and have broad applications for providing warm water, improving heat-pump operations, and enhancing aquaculture systems.

Industrial products and services to help heat and cool buildings through passive natural-energy flows are also available. These include shades, shutters, and screens, thermal energy-storage devices, and greenhouse additions. These products can make major contributions toward reducing energy consumption in buildings.

Cooling and dehumidification are critical needs in many parts of the world. Again, solar energy technology has been applied and demonstrated, operating absorption chillers and Rankine cycle equipment to provide air conditioning.

High temperature solar conversion systems, which use concentrating surfaces and tracking to focus direct sunlight, are now being produced and marketed. These systems include parabolic troughs, optical lenses and dishes for producing such products as industrial steam. Thermal or electrical power can be provided quickly and cleanly in areas where power is not available or is very costly and where sufficient direct sunlight is available.

American design and engineering firms, test laboratories, and technical service organizations are available to provide needed support for all types of renewable energy projects. Specialized teams are involved in expanding the application of all of the types of energy conversion and utilization equipment described above based upon locally available solar energy resources.

All in all, the United States has undertaken one of the most intensive, wide-spread renewable energy programs in the world. These major efforts by government and industry can contribute to economic and social advancement by reducing energy related problems and smoothing the transition from depletable petroleum-based fuels to renewable energies. Hundreds of millions of dollars have been invested by the American public and industry to advance the state-of-the-art of solar and other renewable energies and to improve energy conservation methods. Hopefully, this large investment will help improve international cooperation and reduce dependence on limited and costly energy resources.

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EVALUATION OF ENERGY-RELATED INVENTIONS

This article was prepared by George P. Lewett, Chief, Office of Energy-Related Inventions/NBS.

Introduction

On December 31, 1974, Congress passed the Federal Non-nuclear Energy Research and Development Act of 1974. This Act established a national program to develop new energy sources and the more efficient use of existing energy sources. The responsiblity for carrying out this program was assigned to the Department of Energy (DOE).

In Section 14 of the Act, the Department of Commerce's National Bureau of Standards (NBS) was assigned the role of evaluating energy-related inventions and identifying those that may be suitable for potential DOE support. In assigning the evaluation role to NBS, Congress noted that significant inventions frequently come from individual inventors or from small companies. There was concern that, in the competition for Government funds to be dispensed by DOE, the individual inventor and small company might be at a disadvantage. NBS was directed, therefore, to pay particular attention to evaluation of inventions submitted by individual inventors and by small companies.

On passage of the Act, NBS began receiving requests for evaluation of inventions. By the time the NBS Office of Energy-Related Inventions (OERI) was established in April 1975 to carry out the evaluation program, more than 100 requests were awaiting evaluation. As of January 31, 1981, OERI has received approximately 16,405 requests.

In this article, we will describe the evalaution process designed and implemented by OERI, report evaluation statistics and results, and comment on the impact of the OERI operation on the stimulation of innovation in energy technology.

Objectives and Scope

Evaluation is performed principally as a service to DOE. The objective of the NBS effort, as stated above, is to identify those inventions which may be appropriate for possible DOE support. The nature and extent of support, if any, to be provided is determined by DOE after NBS recommends the invention to DOE.

The NBS evaluation is restricted to review of the invention disclosure and data submitted by the inventor; it does not include testing. Evaluation requests may be submitted by anyone, including citizens of other countries; however, the disclosure must be in the English language. No models are accepted. There is no fee or charge for the evaluation and the proprietary rights of the inventor are not compromised in any way.

The Basic Evaluation Process

The first significant action, after an invention disclosure is received and acknowledged, is referred to as disclosure review and analysis. In this step, the submission is reviewed for appropriateness under Section 14 of the Act. The disclosure is then designated as "ready for evaluation" or "unacceptable." In some cases, additional information may be requested from the submitter.

The disclosure is unacceptable if: (1) it is not energy-related; (2) it is nuclear in nature; (3) it is obviously scientifically flawed (e.g., perpetual motion); (4) it is unclear or incomplete; or (5) it does not contain sufficient technical detail or depth to enable a determination to be made of its feasibility. Suggestions submitted by the general public tend to fall into the last category.

Acceptable invention disclosures are passed through a technical screen referred to as "first-stage evaluation." At least two engineers or scientists review the disclosure independently and sequentially, comment briefly, and make a positive or negative recommendation. Evaluators at this stage are instructed to spend between one-half to eight hours (average one hour) in reviewing the invention and to prepare a one-page, informal technical opinion. The opinions are used as input in the OERI-decision process and are not released outside of OERI. The principal purpose of first-stage evaluation is to identify inventions with "promise" rather than to document why the invention will not work or in what way it is deficient.

If during first-stage evaluation an invention is identified as "promising" or a decision has not been reached, an in-depth "second-stage evaluation" is conducted. At this point, an assumption is made that the invention is likely to be recommended for support. Thus the development of a data and information package suitable for DOE support is emphasized. Evaluators are instructed to contact the inventor if additional information is needed and to spend up to eight person-weeks in the evaluation effort. If the results of the second-stage evaluation are negative, the evaluation report is forwarded to the inventor.

Evaluators and Decision Making

In the evaluation, three basic questions are asked: (1) Will the invention operate as the inventor claims? (2) Will it save energy or increase the available supply of energy if utilized? (3) Given that the invention has the potential to save energy, what are the chances that this potential can be realized? In other words, is development and transfer to the marketplace economically and practically feasible?

The basic evaluation process, after initial disclosure, review, and analysis, is iterative and may draw on a variety of evaluation sources, as depicted in Figure 1. While the typical cycle may consist of two first-stage reviews and a second-stage evaluation, the actual cycle is determined by the OERI senior staff. Further, once an invention is designated for second-stage evaluation, the invention is assigned to an OERI staff evaluator. From that point, the evaluator is responsible for insuring that the invention is thoroughly and effectively evaluated. If the invention is recommended to DOE, the evaluator is also responsible for monitoring DOE action and reporting on the results of the recommendation.

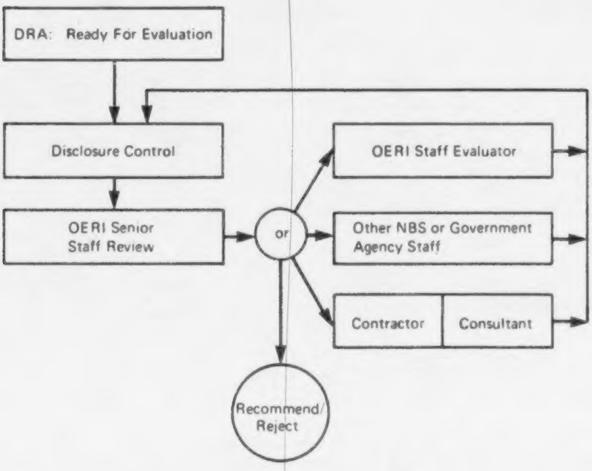


Figure 1

Characteristics of the Evaluation Process

As required by the Act, particular attention in the evaluation process is given to the needs, problems, and characteristics of individual inventors and small businesses. Paper work is minimized with invention disclosures accepted in the form most convenient for the inventor; there are no rigid format requirements. The form (NBS-1019) the inventor uses to request an evaluation asks mainly for the inventor's signature and for information identifying the invention. Only one copy of the disclosure has to be submitted.

Emphasis is placed on safeguarding the inventor's proprietary rights. A rigorous security system has been established. Government personnel and contractors are held formally accountable for each disclosure handled. Accessibility to disclosures is restricted and closely controlled.

A positive attitude is taken in favor of the inventor. The first review of the disclosure is basically nontechnical. The intent is to prepare a disclosure package insuring that the invention receives maximum consideration and that every submission regardless of outward appearance, receives at least one thorough reading and review. Care is also taken to protect the individual and the small business during the dissemination of evaluation results.

Other Process Design Considerations

Experience of other invention programs indicates that of all inventions submitted only a small percentage will be found to have significant value. The yield will vary according to the background of the people submitting the inventions. If the general public is involved, the yield may be less than .1 percent. If the input is restricted to a select technical population (e.g., university professors) the yield may be as much as 6 percent.

Thus, a multi-stage screening and evaluation process was developed based on a greater expenditure of resources on promising inventions. Initial stages in the evaluation process are focused on economically identifying those inventions with promise. Accuracy in evaluation is stressed. The process cannot afford to miss a valuable invention. If it has to err, we wish it to be more likely to err in the direction of calling a poor invention good, rather than the reverse. Performance and yield are carefully documented since the value of the program may be questioned. Performance is being so documented as to facilitate identifying actions which can be taken to increase the yield and thus improve the value of the program.

Experience to Date

Figure 2 charts the flow of inventions as of November 30, 1976. As shown on the chart, the expected yield is 1.3 percent.

Less than 80 percent of the inventions submitted to OERI do not have patents. Of the total inventions submitted for evaluation, approximately 30 percent are already on the market or ready for marketing; for 55 percent of the inventions, funds are being requested for prototype development; the remaining 15 percent are conceptual in nature requiring principally research and development effort.

The subject matter of the inventions ranges from new internal combustion engine designs, to new structural materials, to industrial chemical process improvements. More than 50 percent of the inventions address energy conservation activities with automotive improvements leading the submissions. About 20 percent of the submissions fall into the solar energy area.

Stimulation of Energy-Related Invention and Technology Transfer

The 1.3 percent yield from the evaluation process is a good measure of the innovative ability and innovation output quality of a large and definable technical population. A principal future thrust will be to determine, and possibly implement, actions which could be taken to increase this yield without lowering the standards of acceptability. Such actions could include: Effort to increase participation by proven capable inventors and innovative companies; consultation and other assistance to selected participants to improve disclosure or idea development; publication of material which will guide qualified program participants in selecting promising areas for invention; and appropriate training and education of selected program participants to increase their inventive skills and capabilities.

A valid measure of the performance of an operating process is essential if the process is to be made to change in a favorable way. The statistics being developed by the evaluation program will provide this measure for the process of technological innovation and should lead to direct and favorable stimulation of innovation.

Availability of an evaluation by NBS can also be an aid and a principal first step in the transfer of new energy technology to the marketplace. Although the NBS program is constituted principally as a service to DOE, it is likely that in many areas a favorable NBS evaluation of an invention will enable an inventor to obtain necessary support in the private sector, even if public support does not materialize.

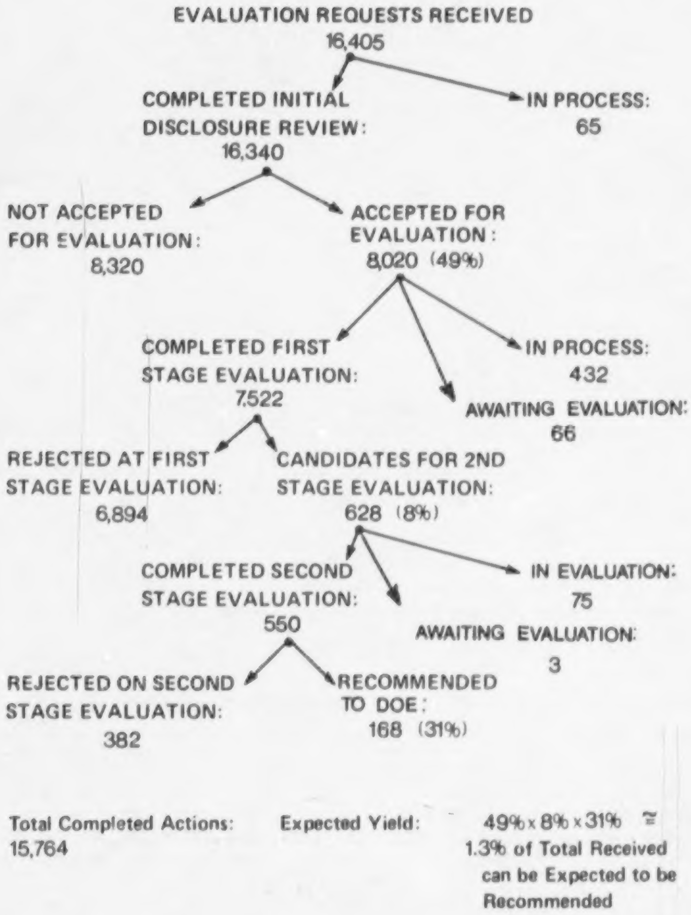
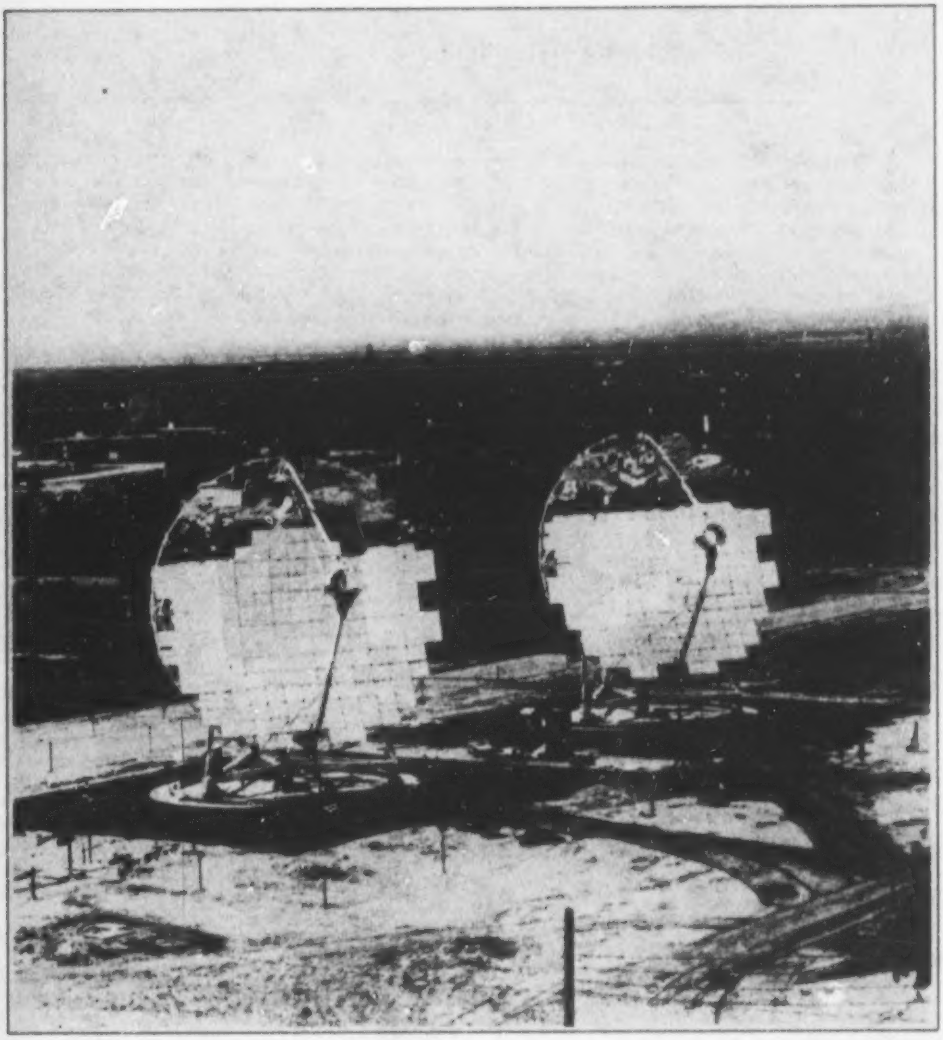

EVALUATION REQUESTS RECEIVED
16,405
COMPLETED INITIAL
DISCLOSURE REVIEW:
16,340
IN PROCESS:
65
NOT ACCEPTED
FOR EVALUATION:
8,320
ACCEPTED FOR
EVALUATION:
8,020 (49%)
COMPLETED FIRST
STAGE EVALUATION:
7,522
IN PROCESS:
432
AWAITING EVALUATION:
66
REJECTED AT FIRST
STAGE EVALUATION:
6,894
CANDIDATES FOR 2ND
STAGE EVALUATION:
628 (8%)
COMPLETED SECOND
STAGE EVALUATION:
550
IN EVALUATION:
75
AWAITING EVALUATION:
3
REJECTED ON SECOND
STAGE EVALUATION:
382
RECOMMENDED
TO DOE:
168 (31%)
Total Completed Actions:
15,764
Expected Yield:
49% x 8% x 31% ≅
1.3% of Total Received
can be Expected to be
Recommended

Figure 2. NBS Evaluation Process Statistics
As of January 31, 1981



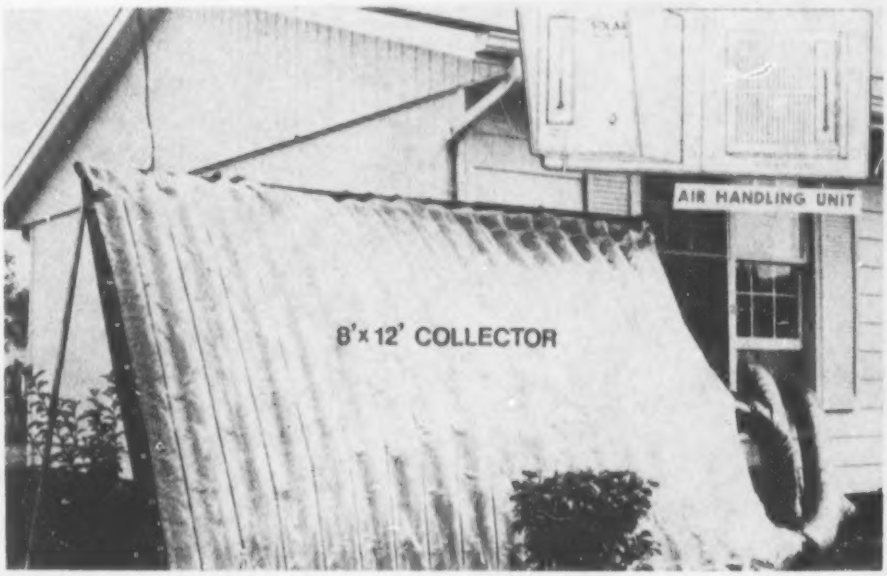
Parabolic Dish Solar Concentrators

Parabolic dish solar concentrators focus extra sunlight onto the absorber of a concentrating collector. Listings for solar collectors begin on page 21.

NEW PRODUCTS USA

The following information on new U.S. renewable energy and energy efficient products has been selected by the Department of Commerce for promotion through the New Product Information Service (NPIS). This information is also made available by Commerce on a selected basis to VOA for worldwide broadcasting. While all the firms mentioned in COMMERCIAL NEWS USA are believed to be reliable, no responsibility can be assumed by the U.S. Government or its representatives for the accuracy of the new product descriptions which are based on information supplied by the listed U.S. firms. Please reprint as many new product descriptions as possible.

AIR COLLECTORS AND SYSTEMS



INFLATABLE SOLAR HEATING SYSTEM — The "Solar Pak II" is a complete forced-air space heating system consisting of an 8.64 m^2 inflatable collector that is adaptable for roof, ground, or wall mounting. According to the firm, the air temperatures will rise 10° to 21° while passing through the collector, exiting at up to 52° C. "Solar Pak II" can be used for residential and commercial space heating and for agricultural uses such as grain drying. The plastic is said to resist tears or cuts and withstand strong winds if properly anchored. The price is $700. Agents and distributors are sought. WRITE: Richard L. Seeman, National Sales Manager, Chicago Solar Corporation, Dept. CN, 2001 Hwy 3 North, Faribault, Minnesota 55021 U.S.A.

SOLAR SPACE HEATER — The "Sunbox" is a 120 by 240 cm residential solar space heater using an integral fan and thermostat to automatically circulate solar heated air through the house during sunny and partially overcast days. Designed to be mounted on a vertical wall with a southern exposure, the "Sunbox" can be easily installed by the homeowner and is said to be maintenance free. The system includes connective back flow dampers. Anti-syphon valves in the dampers prevent cool air from flowing into the house at night and on cloudy days. Agents are sought. WRITE: Bruce Hilde, President, Northern Solar Power Company, Dept. CN, 311 S. Elm Street, Moorhead, Minnesota 56560 U.S.A.

SOLAR WATER PREHEATER — This firm's "Model 8016 Solar Water Preheater" uses a hot air solar collector and is said to eliminate all problems of corrosion, scale buildup in the collector and heat exchanger, and freezing and boiling. Aluminum fins, thermally bonded to the cylindrical surface of a 285-l glass-lined tank, extract heat from the air and transfer it to the water in the tank. The tank is well insulated to minimize heat loss. Water is discarded when temperatures reach 88° C, and cold water is added which prevents problems of boiling over, explains the firm. Distributors are actively sought for this system priced from $1,000 to $1,200. WRITE: Richard C. Greig, President, Park Energy Company, Dept. CN, Star Route Box 9, Jackson, Wyoming 83001 U.S.A.

NEW SOLAR HEATING SYSTEM WITH AIR COLLECTOR — This firm's "Sierra Ray Solar Heating System" is said to heat water and air temperatures up to 82° C for residential, commercial, and industrial heating needs. By using an air collector, explains the firm, problems of boiling, freezing, and corrosion are eliminated. The 304-l glass-lined storage tank is surrounded by 6.4 cm of urethane insulation. Additional features include a pressure temperature relief valve, tank drain valve, and a tempering valve. System controls are factory installed and prewired, minimizing wiring at the installation site. Interfacing hardware is provided to simplify assembly. Distributors and licensees are sought for this system priced from $2,000 to $3,500. WRITE: Robert V. Butterfield, Director of Marketing, Alternative Energy Resources, Inc., Dept. CN, 1155K Larry Mahan Drive, El Paso, Texas 79925 U.S.A.

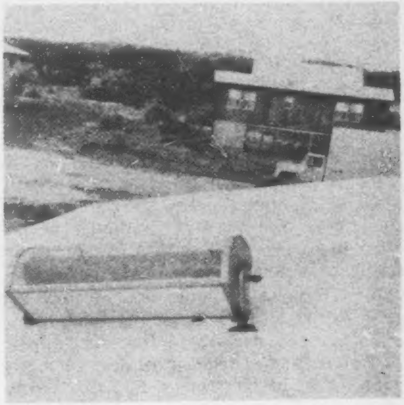
SOLAR AIR HEATER — Fuel bills can be cut by using the "Solar Air Heater," says the manufacturer. Easily installed in a wall with a southern exposure, the "Solar Air Heater" delivers heat into the room whenever the sun is shining. When the temperature inside the collector reaches 39° C, the blower automatically turns on, drawing room air into the collector and across the plate where it is heated and transferred back into the room. The blower automatically shuts off when the temperature in the collector drops to approximately 26° C. WRITE: Dr. Carl Schleicher, President, Solartherm, Inc., Dept. CN, 1110 Fidler Lane, Silver Spring, Maryland 20910 U.S.A.

FLAT PLATE LIQUID COLLECTORS AND SYSTEMS

COLLECTOR USES UNIQUE PLATING PROCESS — This firm's "BC-32" solar collector can be used in residential and commercial solar hot water systems. Constructed of copper, the collector is plated in a special dull Watts nickel bath prior to the final "Black Chrome" plating, which is said to achieve a 95 percent absorption rate. This unique plating process, explains the firm, enables the collector to increase the amount of Btu's captured. A special etching process for the absorber plate assures maximum adhesion of the nickel. This collector is priced at approximately $107/m^2. Agents and distributors are sought. WRITE: Steve Sipek, President, Black Chrome Solar Power Inc., Dept. CN, 2805 Pinewood Avenue, West Palm Beach, Florida 33407 U.S.A.

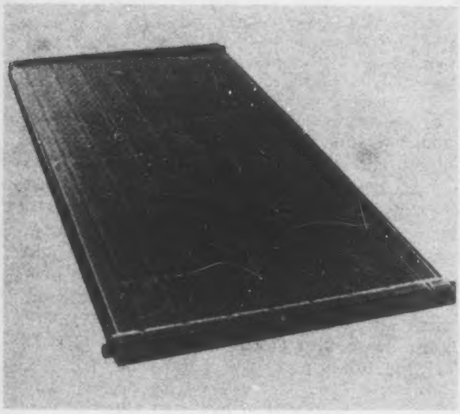
COST EFFECTIVE SOLAR COLLECTOR — According to the firm, "Sunburst Solar Energy Collectors" are among the most cost effective collectors available in terms of heat collected per dollar. These collectors can be used in residential or commercial hot water and space heating systems. The collector can be shipped in parts, an advantage, the firm says, that makes it less costly. Constructed of high quality materials with optional features such as glazing, the collector is said to operate effectively in different environments. Instruction manuals can be provided in any language to aid installation. Distributors are sought for these collectors priced from $150 to $350. WRITE: Elizabeth Szombathy, Vice President, Atlas International Group, Dept. CN, 220 West Mercer Street, Suite 204, Seattle, Washington 98109 U.S.A. Telex: 320156. Cable: ATSITG.

PASSIVE SOLAR WATER HEATER — Homeowners, vacation resorts, and remote cabins are potential users of the "Summersun Passive Solar Water Heater." This water heater is fully self-contained and requires no controls, pumps, or electricity to operate. A safety temperature and pressure valve is included in the water heater's design. The collector/storage system may be mounted on the roof or installed in the ground and has an adjustable leg to aid in obtaining optimum solar orientation. The collector area is .90 m^2, and the tank has a 114-l capacity. According to this firm, installation is extremely simple and can be done by the homeowner. Temperature rises of 21° C are said to have been shown. The export price is $600. WRITE: Marnie Herring, Manager, Solar American Company, Inc., Dept. CN, P.O. Box 2088, Newport News, Virginia 23602 U.S.A.



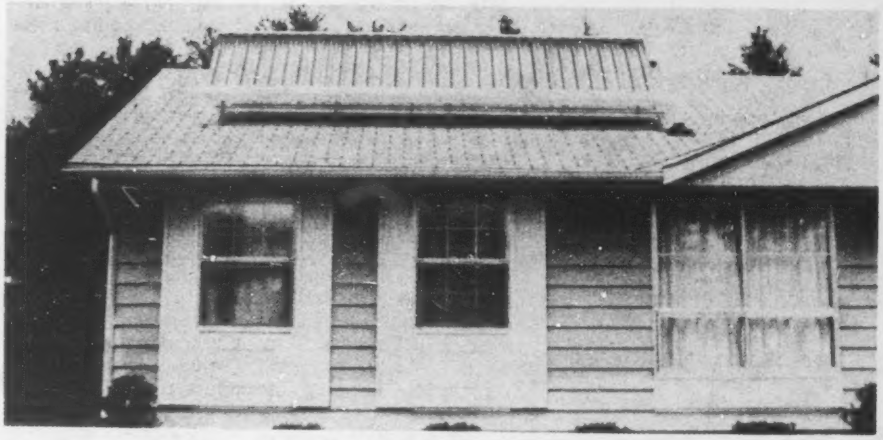
HIGH-PERFORMANCE, LIGHTWEIGHT SOLAR COLLECTOR — The "Solergy Model SG-201" is an all copper, flat plate, liquid, solar collector which can be used by businesses and homes in hot water or space heating systems. The copper absorber with integral tube and header design and black chrome selective coating maximizes the heat transfer capabilities of the materials for greater overall efficiency, according to the firm. A unique combination of fiberglass and foam insulation is said to result in an R-value of 12. Enclosed in an aluminum frame with a fiberglass reinforced polyester material glazing, the firm says the collector can withstand extreme temperature variations and is 28.8 kg lighter than glass glazed units, permitting easy shipping and installation. Operating temperatures are 38 to 60° C. WRITE: Joseph Fischer, Solergy Company, Dept. CN, 7216 Boone Avenue N., Minneapolis, Minnesota 55428 U.S.A.

NEW LONG-LIFE SOLAR COLLECTOR — According to the firm the "NSC-100 Flat-Plate Solar Collector" is engineered to meet the most rigid building requirements where durability and sustained performance over a 30-year life cycle are design objectives. Constructed entirely from copper, tempered glass, and aluminum, the collector is said to meet the wide ranging requirements for residential hot water, commercial space heating, and industrial process hot water. The export price range is from $600 to $1,000. Inquiries from potential sales representatives are welcomed. WRITE: Mark Uhran, Manager, National Solar Corporation, Dept. CN, Main Street, Centerbrook, Connecticut 06409 U.S.A.

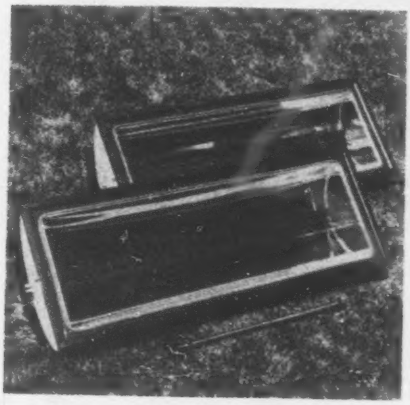


DURABLE SOLAR COLLECTOR FOR INTERMEDIATE TEMPERATURES — The durable, lightweight, and corrosion resistant "GL Solar Collector" is said to be ideally suited for a broad range of efficient solar heating applications. Pool and spa owners are some of the potential end-users of this collector. According to the manufacturer, the collector can also serve as a primary heat source for water based heat pumps in space heating and for domestic hot water in more tropical climates. The "Collector" consists of a polypropylene absorber plate with long-life coated acrylic glazing. It combines, the firm says, the advantages of the low temperature, low cost plastic collector and the metal, medium temperature collector. The firm is actively seeking distributors for this collector priced at $300. Bank reference: Central Jersey Bank and Trust Company, Holmdel, New Jersey. WRITE: Marcel Bally, General Manager, Solar Industries International, Inc., Dept. CN, Monmouth Airport Industrial Park, Farmingdale, New Jersey 07727 U.S.A. Telex 642671.

LIGHTWEIGHT, EFFICIENT SOLAR PANEL — According to the firm, this "Arctic Solar Heater" provides an economical and efficient means to capture solar insolation. The panel is said to be capable of providing domestic hot water for two people at 49° C in a 300-l insulated tank. A unique feature, says the firm, is the "Solar Heater's" capability to achieve over 81 percent instantaneous efficiency. Construction includes a convexed copper absorber plate and an acrylic window .32 cm thick. The total insolation receiving area is .65 m^2. Weighing 20 kg, the "Arctic Solar Heater" can be easily handled and installed by one person, says the firm. Licensees are actively sought for this product priced at $190. A discount price is offered for large orders. WRITE: Richard Dawley, Sr., Owner, Solar Magnetic Labs., Dept. CN, 121 Riley Avenue, Lake Worth. Florida 33461 U.S.A.



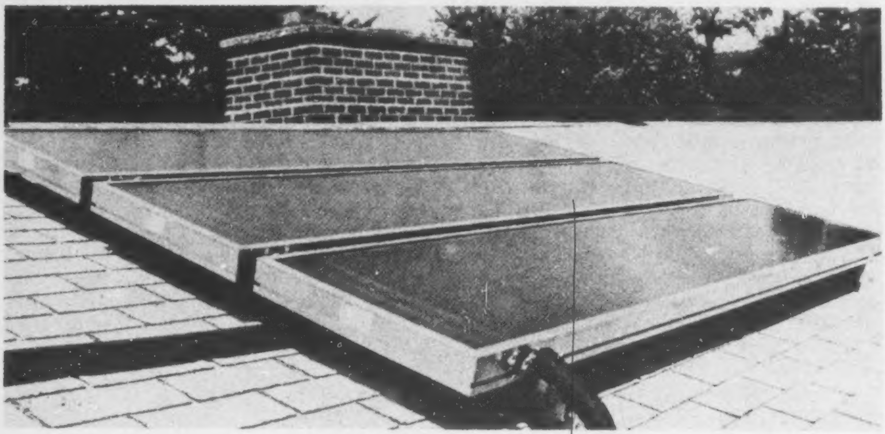
INTEGRATED TWO-TANK HOT WATER SYSTEM — The "Solar Hot Water System" combines the conventional hot water tank and the solar fluid storage tank into one compact unit. The system's tank is glass-lined and holds 304 l. The system uses borosilicate glass evacuated tube collectors which are said to virtually eliminate heat loss and resist corrosion. Featuring a drainable manifold, the collectors drain through the insulated manifold into the storage tank at the end of the day. This feature, according to the firm, allows efficient operation in all climates, including cold and cloudy weather, and, in addition, protects the system from freezing or a boil-out in a power failure. The entire tank measures 201 cm high and is said to operate at temperatures from 66° to 121° C. The export price is $2,000 to $4,000. WRITE: Jerome Nykiel, Director of Marketing and Sales, Sunmaster Corporation, Dept. CN, 12 Spruce Street, P.O. Box 1214, Corning, New York 14830 U.S.A.



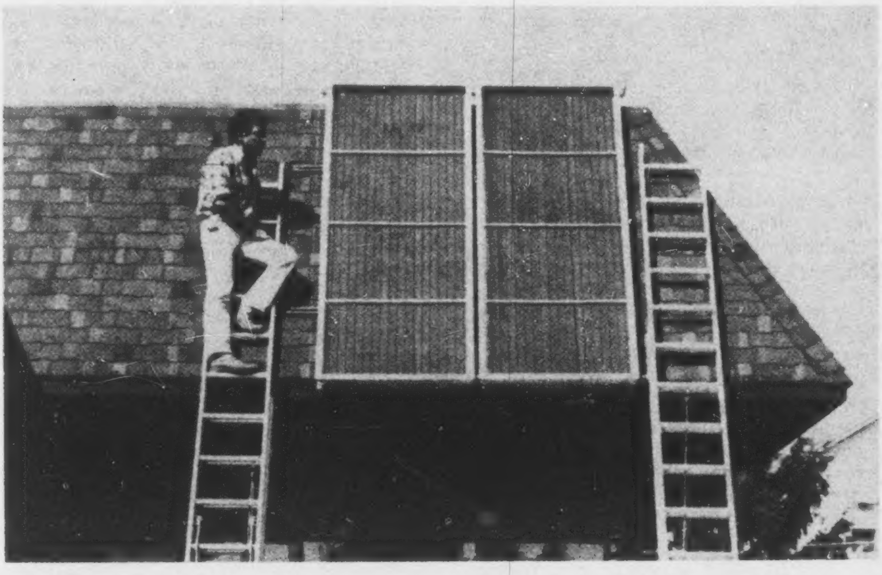
SOLAR HOT WATER PACKAGE — This firm's "Suncycle Domestic Water Heater" is said to be a simple, efficient, and reliable package which provides up to 70 percent of the hot water needs for a typical family of three. The package converts any standard water heater to a solar hot water tank, regardless of the backup fuel source and without need for a preheater tank. Included in the package are two Sunpump collectors, a Suncycle heat exchanger, all special parts and fittings, insulation (including a blanket for the existing water heater) and installation instructions. The price is from $2,000 to $3,000. WRITE: Mr. M. W. Frank, President, Entropy Limited, Dept. CN, 5735 Arapahoe, Boulder, Colorado 80303 U.S.A.

ALL WEATHER SOLAR SYSTEM — The unique feature of the "Subambient Solar Systems," explains the firm, is their ability to operate in all weather conditions by using a liquid/vapor mixture to absorb additional low-grade heat from the surrounding environment. In the process, the vapor is compressed and liquified, releasing heat which warms the water being pumped through the condenser. According to the firm, all but 5 to 10 percent of the incident solar energy is collected and utilized. The systems are said to be easily adaptable to new construction and retrofitted buildings for residential or commercial hot water and space heating, and do not require storage, large collector areas, or southern exposures. The collector contains no glass and is said to require minimal maintenance. Agents, distributors, and dealers are sought for these systems which start at $1,400. WRITE: Jerry Kaye, Vice President of Sales and Marketing, Solar Specialties, Inc., Dept. CN, Route 7, Box 409, Golden, Colorado 80401 U.S.A.

CORROSION RESISTANT, LIGHTWEIGHT COLLECTOR — This firm's "SolaRoll SRX-290 Collector" has been designed specifically for domestic hot water production. The collector incorporates the company's unique SolaRoll tube mat of extruded EPDM (Ethylene Propylene Dynel Monomer) elastomer within an aluminum frame, glazed with low-iron glass and insulated with foam. The "SRX-290" is 2.8 by .65 m and weighs 34.5 kg. Resistant to freezing and corrosion, according to the firm, the collector is said to be easily installed on specially designed adjustable aluminum mounting racks for roof or ground mounting. Distributors and agents are sought for this collector priced at $310. WRITE: Steven Krulick, Vice-President, Bio-Energy Systems, Inc., Dept. CN, 221 Canal Street, Box 191, Ellenville, New York 12428 U.S.A. TWX: 5102408340.



COMPLETE, PRE-ASSEMBLED SOLAR HEATING SYSTEM — The "Solar Pac System" is a fully integrated, pre-assembled solar package for residential, commercial, or industrial hot water and space heating applications. Lightweight and easy to install, says the firm, the package contains all copper solar controllers, a pumping control module, storage tank system kit, and complete instructions for installation and service. The system can be modified for different climates. Agent and licensee inquiries are welcome. The pre-assembled package is priced from $1,000 to $4,800. WRITE: Leon V. Skalish, Jr., Marketing Manager, Paolino Energy Products, Inc., Dept. CN, Mid-Atlantic Industrial Park, 1501 Grandview Avenue, West Deptford, New Jersey 08066 U.S.A. (Photo below)



COMPLETELY MODULARIZED SOLAR HEATING AND HOT WATER SYSTEM — According to the firm, this unique "Solar Fire Heating System" is a complete modularized solar heating system providing 100 percent of hot water and space heating requirements in new or retrofitted homes and offices. The system includes a hydronic wood or coal burning stove as the backup unit, which stores energy in the central storage tank for later use. The preplumbed and prewired storage tank features all copper heat exchangers, pumps, valves, and digital readout computer controller. The tank's insulation is said to have a R factor of 35. The collectors feature all copper waterways, extruded aluminum frames, and an unbreakable glazing. The average price of a system for a $225m^2$ home or office is approximately $10,000. Bank reference: Equitable Trust Company, Temple Hills, Maryland. WRITE: Russell Pandina, President, Marketing and Engineering, Futuristic Solar Systems Corporation, Dept. CN, 4900 Beech Place, Temple Hills, Maryland 20031 U.S.A.

MEDIUM TEMPERATURE SOLAR COLLECTOR — This firm's "SD7 Medium Temperature Solar Collector" is said to be lightweight, durable, and capable of withstanding high wind loads. Enclosed in an aluminum frame with aluminum and stainless steel fasteners, the collector is particularly suited for salt air climates, says the firm. The collector features an all copper absorber plate, with optional black chrome selective coating and a low-iron tempered glass glazing, said to provide maximum energy transmission. The export price range is from $230 to $285. WRITE: Pat J. Sacco, Vice President, Solar Development Inc., Dept. CN, 3630 Reese Avenue, Riveria Beach, Florida 33404 U.S.A.

HIGH PERFORMANCE, MEDIUM TEMPERATURE COLLECTOR — This "CU30-WW" medium temperature collector for domestic hot water features an advanced design absorber plate combining copper flow tubes mechanically expanded into an aluminum wing, according to the firm. High thermal performance is said to be obtained by incorporating closed cell insulation, a glass cover plate with high transmittance capabilities, and a highly absorbant, durable plate coating. The "CU30-WW" features a custom aluminum extruded framewall said to be designed for strength and versatility in mounting. WRITE: Jack C. Ryals, President, Solar Energy Products, Division of SEP, Inc., Dept. CN, P.O. Box 1048, Gainesville, Florida 32602 U.S.A.

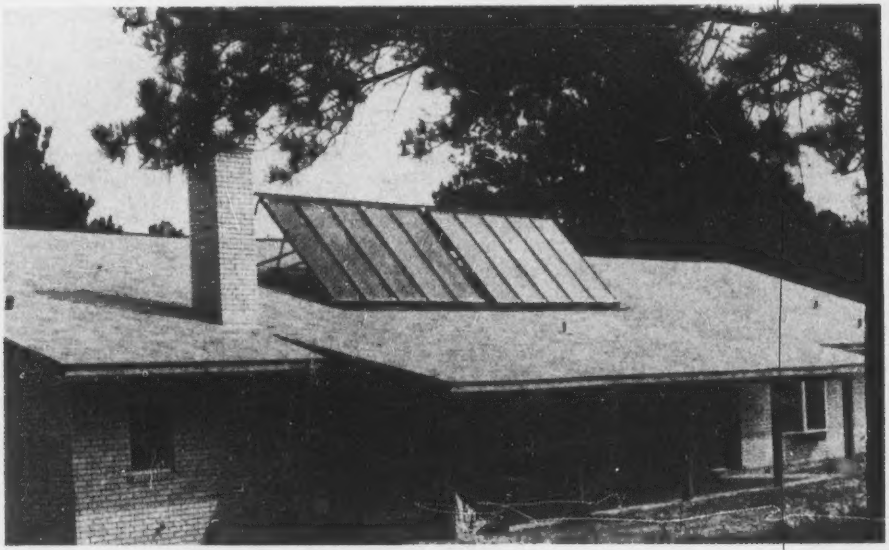
NEW COLLECTOR FOR HEATING APPLICATIONS — The "Sol-Arc" solar collector features an extruded aluminum frame, stainless steel fasteners, efficient insulation, and low-iron tempered glass. The new and unique absorber, explains the firm, utilizes a grid pattern design which results in earlier pickup and later retention of the sun's rays throughout the day for maximum generation of thermal energy. The tapered fin of each section aids in the quick transfer of heat to the circulating fluid of the panel, according to the firm. The "Sol-Arc" collector can be used for domestic hot water, space, pool, or spa heating. Agents, distributors, and licensees are sought for this collector priced at $260. WRITE: Raymond R. Lupkas, Sun-Ray Solar Equipment Company, Inc., Dept. CN, Four Pines Bridge Road, Beacon Falls, Connecticut 06403 U.S.A.

BOXED, GLAZED, AND INSULATED SOLAR COLLECTOR — This firm's "BGI-Series Collector" for domestic hot water features a modular, boxed construction forming a seal around the solar absorber, glazing to minimize heat losses caused by the wind, and a special insulation on the back of the collector to contain heat. The collector uses a unique hollow core profile absorber panel constructed from a co-polymer material which is totally inert and not affected by scaling or strong chemicals. The panel, explains the firm, is designed to provide uniform water distribution throughout the entire width of the collector for maximum heat gain. Easy to handle and install, the system includes the hardware necessary to accommodate any configuration. Agents, distributors, and licensees are sought. The collector price ranges from $120 to $250. WRITE: Rick Geatty, Marketing Manager, Sealed Air Corporation, HCP Solar Division, Dept. CN, 3433 Arden Road, Hayward, California 94545 U.S.A. Telex: 172-181.

PRACTICAL, LIGHTWEIGHT SOLAR COLLECTOR — This firm's low cost "SunGrabber" collector is used in domestic hot water, space, and pool heating systems. This lightweight collector is said to be easily handled and installed. The product's unique advantage, explains the firm, is its compatability with all types of heat transfer fluids. The 90 by 240 by 8.5 cm collector features a copper absorber and a silver brazed manifold assembly in a one-piece aluminum housing with fiberglass glazing. The suggested wholesale price is $310, with discounts available on large quantity purchases. Distributor inquiries are welcome. WRITE: Jerry W. Wilkes, President, Wilkes Sun Energy Systems, Inc., Dept. CN, P.O. Box 1842, Hobe Sound, Florida 33455 U.S.A.

BEST COPY AVAILABLE

NEW LOW COST, HIGH EFFICIENCY SOLAR COLLECTOR — This firm's new low cost, high efficiency "SS-10" solar collector has been designed for any residential and commercial hot water heating or industrial process heat applications requiring less than 100° C temperatures. The "SS-10," explains the firm, features a 100 percent copper absorber plate coated with a selective black chrome surface, internal headers for easy connection and piping, an anodized aluminum frame with continuous mounting range for easy installation, low-iron, tempered glazing for strength, and a high performance insulation for maximum control of heat loss. The price ranges from $260 to $300. Distributors are sought. WRITE: Brian D. Pardo, President, American Solar King Corporation, Dept. CN, 7200 Imperial Drive, P.O. Drawer 7399, Waco, Texas 76710 U.S.A. Telex: 730916.



EASILY ASSEMBLED, LIGHTWEIGHT SOLAR COLLECTOR — This firm's "Sun-Miser Collector" is designed for both integral mounting in new roofing construction and retrofit applications. The flat-plate collector is enclosed in a single glazed, high thermal fiberglass housing which resists corrosion. Using a copper absorber, fiberglass insulation, and a low-iron glass cover plate, the collector is said to provide maximum efficiency per square meter, according to the firm. For domestic, commercial, or industrial hot water, the "Sun-Miser Collector" starts at $270. Licensees to assemble and distribute this lightweight collector are sought. WRITE: James K. Nordin, President, Sun-Pac, Inc., Dept. CN, P.O. Box 8169, Alexandria, Louisiana 71306 U.S.A. (Photo above)

DOMESTIC HOT WATER SYSTEM FEATURES UNIQUE COMPONENT — This firm's new "Sunstream" domestic hot water system for freezing and non-freezing climates features the 300/400 Series Collector and the Sunstream Module. The unique feature of the system, explains the firm, is the module unit which contains all the necessary pumps, valves, piping, and other components needed to bring solar heat from the collectors to the water supply. The module is available for both open-loop and closed-loop systems. According to the firm, the 300/400 Series Collector is lightweight and yields high Btu's per installed dollar. Licensees are actively sought for this system priced from $950 to $1,700. WRITE: Michael S. Cucurullo, Manager, Energy Programs, Grumman International, Inc., Dept. CN, 1111 Stewart Avenue, Bethpage, New York 11714 U.S.A. Telex: 961-430. Cable: GRUMAIR.

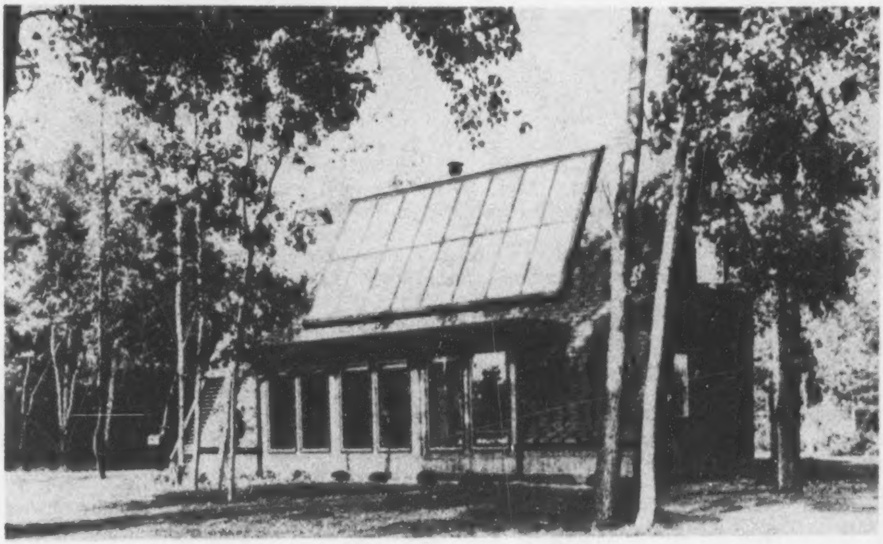
SOLAR ROOFING SYSTEM — Any new or retrofitted building can use this firm's "Solar Shingle Collector System" for solar hot water or space heating. A closed loop system, it consists of a manifold panel (or array of panels) with aluminum or steel tubing covered with fiberglass in lengths up to 15 m. By using a heat transfer oil, explains the firm, problems occurring from corrosion, freezing, and boiling are eliminated. According to the company, large solar systems can be built at a fraction of the cost of conventional solar products. Dealers are sought for this collector priced at $12.25/m. WRITE: James C. Purdy, President, J & J Solar, Inc., Dept. CN, 1615 E. Catalina Drive, Phoenix, Arizona 85018 U.S.A. (Photo above)

HIGH TEMPERATURE FLAT PLATE SOLAR COLLECTOR — This firm's new "Series 100 Solar Collector" features a copper absorber and an all fiberglass package which the firm says will resist climatic changes and ultraviolet rays. According to the firm, the assembly process is minimized by the use of rubber gaskets which hold the solar glass in place, eliminating the need for sealants. Commercial, industrial, and residential buildings can use this flat plate collector which is said to produce temperatures for hot water or space heating up to 121° C. The export price is $500. WRITE: Richard Broderick, Vice President, Sun Sav Inc., Dept. CN, 640 South Union Street, Lawrence, Massachusetts 01843 U.S.A.

RELIABLE, LOW MAINTENANCE SOLAR COLLECTOR — In addition to sharing many of the traditional design concepts of solar collectors, this firm's "HP-150 Solar Collector" is said to be a mild concentrator. Internal reflectors around the perimeter of the absorber plate produce a mild concentration effect by directing extra radiation to the absorber plate during the central hours of the day. The use of internal reflectors reduces collector heat losses and is said to result in efficient operating temperatures from 38° to 98° C. For use in domestic and commercial hot water and space heating and cooling systems, the collector is priced at $325. WRITE: R. Gary Ford, President, Energy Design Corporation, Dept. CN, 1756 Thomas Road, P.O. Box 34160, Memphis, Tennessee 38134 U.S.A. Telex: 05-3827.

NEW LOW PROFILE SOLAR COLLECTOR — For residential, commercial, and industrial users of hot water, this new "Solar Collector" features a copper absorber plate and aluminum frame for high efficiency. Glazed and unglazed models are available for both low flow and high flow requirements. Black paint and black chrome absorber surfaces are also offered. Measuring 91 cm wide, 245 cm long, and 6.4 cm thick, the low profile collector is priced from $380 to $460. Agents and distributors are sought. WRITE: Robert H. Aninger, Director of Marketing, Dean Solar Systems, Dept. CN, 23018 South Normandie, Torrance, California 90502 U.S.A.

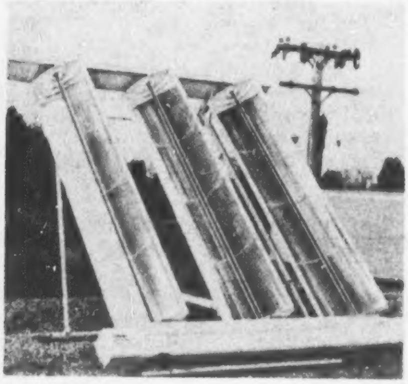
PREFABRICATED SOLAR HOME — According to this firm, "Solartran Homes" are designed, engineered, and assembled to provide an energy efficient, prefabricated home that is both attractive and inexpensive. These cedar homes have complete solar hot water and space heating systems to protect home owners from rising fuel costs. Passive designs are also available. Owners can move into the "Solartran Home" within six to ten weeks from the start of construction. Distributors are sought for these $25,000-$50,000 homes. Bank reference: Seattle First National Bank, Seattle, Washington. WRITE: Elizabeth Szombathy, Vice Pres., Atlas International Group, Dept. CN, 220 West Mercer St., Ste. 204, Seattle, Washington 98109 U.S.A. Telex: 320156. Cable: ATSITG.



CONCENTRATING COLLECTORS AND SYSTEMS

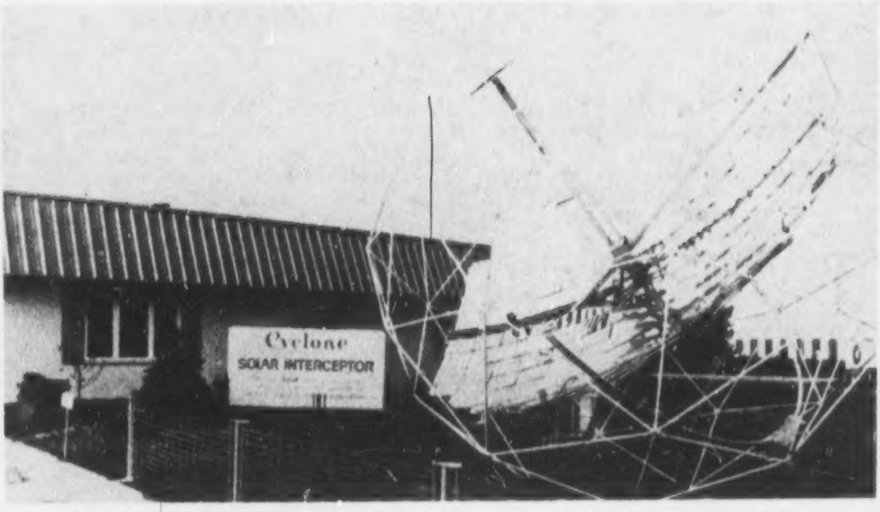
SOLAR HOT AIR GENERATOR — The "Heliodyne Model HTC-6000," consisting of a concentrating collector and integrated exchanger, concentrates the sun's rays to a sharp focus, heating air to 871° C. It produces hot water and space heat up to 250,000 Btu daily. The unit can also store energy for delivering heat when there is no direct sunlight. End-users include residential, agricultural, industrial, and commercial sectors. This compact modular unit is said to be easily fitted to existing plumbing and can be installed in a few hours. The price is $6,000-$10,000. WRITE: William P. Dampier, Principal, OMNIUM-G, Dept. CN, 1815 1/2 North Orangethorpe Park, Anaheim, California 92801 U.S.A.

PORTABLE SOLAR COOKER — Efficient and compact, the versatile "Solar Energy Cooker" can be used in isolated areas such as mountains, deserts, and arctic regions or by homeowners on a balcony or terrace, the manufacturer says. A wide range of foods can be cooked without the danger of fire or the annoyance of smoke. Safe for use around children, the reflector remains cold while heating the underside of pans to temperatures ranging from 250° to 600° C. The "Solar Energy Cooker" is priced at $89.95. WRITE: Mr. Jean A. Moullet, Proprietor, Sun Way Solar Energy, Dept. CN, 7811 Alabama Avenue, Canoga Park, California 91303 U.S.A.



COMPLETE SOLAR ENERGY SYSTEM — The "Tona-Tec Solar System" uses a unique reflector insert in the parabolic trough collector to obtain an optically efficient design. The storage tank can withstand fluid temperatures in excess of operating requirements, permitting applications not possible with flat plate collectors, says the firm. A 12-V d.c. motor adjusts the angle of the collectors during the day and for seasonal changes. Preassembled for easy installation, the "Tona-Tec Solar System" can be used for a variety of applications including hot water, space heating, air conditioning, and industrial process heat applications from 79° to 205° C. The export price is $3,500 a unit. WRITE: David Chenault, Pres., Toltec Industries, Inc., Dept. CN, 40th and East Main St., Clear Lake, Iowa 50428 U.S.A.

TRACKING REFLECTOR — The "Heliostat" concentrates solar energy to produce hot fluids. Constructed of standard flat mirrors, the modules are mounted on a steel substrate with an intervening layer of silicone grease, enabling the mirror to maintain flatness at all temperatures. The drive unit, consisting of a planetary reducer operating into a "worm gear" output, is powered by a computer controlled stepper motor for precision positioning. Uses include enchanced oil recovery, process heating, and desalinization power generation. The price is $20,000-$30,000. WRITE: Floyd A. Blake, Dir., Heliostat Laboratory, Northrup, Inc., Dept. CN, 7061 S. University Blvd., Ste. 306, Littleton, Colorado 80122 U.S.A.



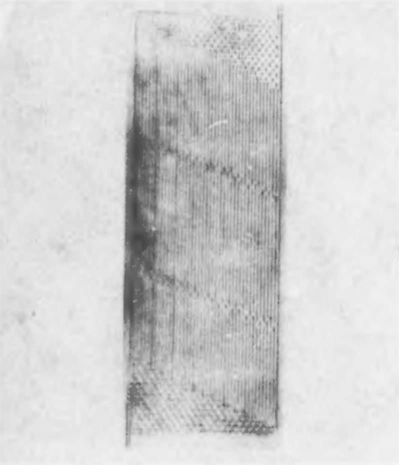
AUTOMATIC TRACKING SOLAR COLLECTOR — The "Solar Interceptor" is a self-orienting collector that produces water temperature from 82° to 88° C. The unit, containing 175 mirrors focusing the sunlight on a water cooled heat exchanger, can collect about 450,000 Btu in a ten-hour period of clear sunlight, says the firm. This collector has a 5-m diameter supported by a geodesic "globe" of epoxy coated tubular steel with a 505-cm diameter. Uses include supplemental heating of agricultural, commercial, and residential buildings. Agents are sought for this $6,000-$8,000 unit. WRITE: Warren Stuk, Executive Vice-President, Cyclone International Inc., Dept. CN, P.O. Box 1017, Holland, Michigan 40423 U.S.A.

CONCENTRATING COLLECTOR FOR INDUSTRIAL PROCESS HEAT — This firm's "Model 3001-03 Concentrating Collector" is a reflecting parabolic trough collector designed to heat fluids to temperatures between 60° and 316° C. In this high temperature range, the collector is said to be cost effective compared to flat plate collectors and other concentrating collectors. Built with rugged, long-life components, the collector is said to be ideally suited for many applications including industrial process hot water and steam, space heating and cooling, and Rankine cycle power generation systems. The price is $100,000. WRITE: John Dennis, Vice Pres., Acurex Solar Corporation, Dept. CN, 485 Clyde Ave., Mountain View, California 94042 U.S.A. Telex: 34-6391. Cable: 910-3796593.

NON-TRACKING CONCENTRATING COLLECTOR — The "Non-tracking Concentrating Collector" uses an anodized aluminum parabolic reflector focusing on a copper absorber plate with a black chrome selective surface. The firm explains that the collector's advantage is its unique design for high Btu output during a nine-month heating season, in addition to a heat rejection capability during the summer months which reduces summer overheating and stagnation problems. Commercial hot water applications requiring temperatures up to 121° C, such as laundries, restaurants, and space heating are some applications. The export price is $1,200. WRITE: Jack D. Elmore, Pres., Sun-Heet Inc., Dept. CN, 11965 East 49 Ave., Denver, Colorado 80239 U.S.A.

COLLECTOR COMPONENTS

LOW COST SOLAR ALUMINUM EXTRUSIONS — With gaskets, glass, insulation, and absorber, these "Solar Collector Aluminum Extrusions," explains the firm, permit easy, low cost assembly of solar collectors by manufacturers and do-it-yourself builders. The "Extrusions" measure 11.72 cm high and 5 cm on each side and are made in 18 m lengths. They are cut to size, drilled, and painted before shipping. The price is less than $6.60/m. Plans are available for several models. WRITE: M. Goldberg, Pres., Practical Solar Heat, Inc., Dept. CN, 2216 Montgomery St., Bethlehem, Pennsylvania 18017 U.S.A.



ALL COPPER ABSORBER FOR SOLAR COLLECTORS — The newly introduced "Solar Bond Absorber Plates" are completely constructed of copper, a high thermal-conductivity metal which is said to improve collector efficiency. Tubes and headers within a copper plate form integral flow passages which, the firm explains, provide close tube spacing, uniform flow and large wetted heat transfer areas. "Solar Bond Absorber Plates" can be used in liquid based flat plate solar collectors for water, space and industrial heating, etc. The firm claims its absorbers can drain efficiently in either a horizontal or vertical position. The price starts at $106. WRITE: C.O. Kunz, Dir., International Sales, Olin Corporation/ Brass Group, Solar-Bond Products, Dept. CN, East Alton, Illinois 62024 U.S.A. Telex 62826.

HEAT TRANSFER FLUID FOR SOLAR COLLECTORS — This firm's "Solar Guard" heat transfer fluid is available to owners of solar collectors used for domestic hot water, swimming pools, and space heating. This fluid is an inhibited propylene glycol solution with excellent heat transfer properties under varying temperature conditions, according to the firm, and is also said to provide protection from freezing and corrosion. In water solutions normally used in collectors, "Solar Guard" is said to be both nonflammable and practically nontoxic. The price per 3.8-l container is $6. Distributer inquiries are welcome. WRITE: W. P. Conrath, Vice-President, Douglas Chemical Company, Dept. CN, P.O. Box 297, Liberty, Missouri 64068 U.S.A.

NEW POLYMER WITHSTANDS EXPOSURE TO SUN'S RAYS — According to the firm, this new thermoplastic polymer, "Rovel," has high initial impact strength and outstanding retention of physical properties and appearance after long periods of exposure to the ultraviolet rays of the sun. "Rovel" can be used as a protective coextruded outer layer on solar applications such as photovoltaic cell housings, flat plate collectors, etc. "Rovel" is priced at about $3.30/kg. Bank reference: Morgan Guaranty, New York, New York. WRITE: Philip G. Haas, Marketing Specialist, Uniroyal Chemical, Division of Uniroyal Inc., Dept. CN, Spencer Street, Naugatuck, Connecticut 06770 U.S.A. Telex: 962460. Cable: UNIROYAL CHEMICAL.

NEW ABSORBER PLATE DESIGN — For use in solar hot water and space heating systems, this firm's all copper "Absorber Plate" resists corrosion and is designed, says the firm, for high performance at a low cost. Unique features listed by the manufacturer include metallurgical bonding of the absorber sheet to the tubes for optimum heat transfer, silver brazed waterway connections, and fluid tubes on 5.08 cm centers producing a large wetted surface area for higher efficiency and lower overall plate temperature. According to the firm, this "Absorber Plate" delivers one of the highest heat removal factors in the industry. Lightweight, the "Absorber Plate" is easy to install and is priced from $50 to $125. WRITE: Jeffrey R. Wootan, Sales Manager, Terra-Light, Inc., Dept. CN, 30 Manning Road, P.O. Box 493, Billerica, Massachusetts 01821 U.S.A.

SUNSPOOL
Collector Drain-Down Valve
DRAIN
OPERATE
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SUNSPOOL CORP. PALO ALTO, CA
SUNSPOOL
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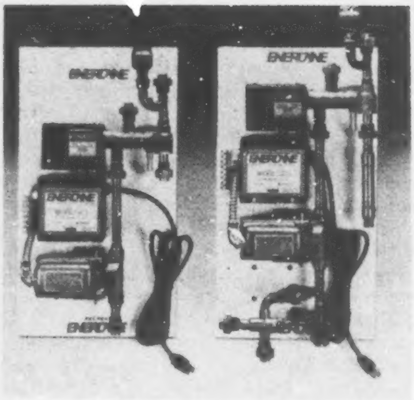
COLLECTOR DRAIN-DOWN VALVE FOR FREEZE PROTECTION — The "Sunspool Drain-down Valve" is specifically designed for the freeze protection of "direct" or "open-loop" solar water heating systems with collector arrays of up to 13.5 m^2. When activated, the valve automatically fills the collector array with pressurized city water, permitting normal pumped circulation under highly efficient, direct-heating conditions. When de-energized by controller function or by a power interruption, the valve automatically isolates the collector array from the city water supply and drains the collectors. Installation is easy, and the cartridge/drive assembly can be removed for servicing, according to the firm. The price is from $60 to $80. WRITE: Harry T. Whitehouse, President, Sunspool Corporation, Dept. CN, 439 Tasso Street, Palo Alto, California 94301 U.S.A. (Photo above)

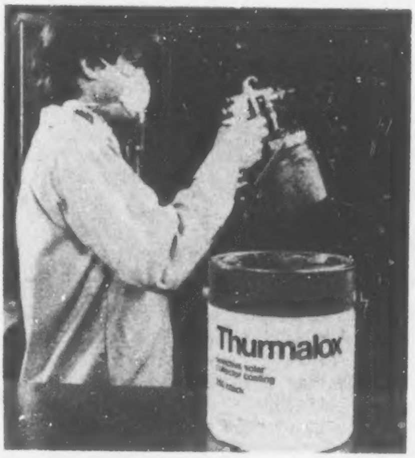
LOW-IRON SOLAR GLASS — Manufacturers of solar collectors can use this firm's new, low-iron composition "Solar Glass." The unique advantage of this "Solar Glass," says the firm, is its ability to absorb and transmit the maximum amount of the sun's energy as a result of reduced iron-oxide content in the glass. Fully tempered, the glass is said to be three to five times stronger than ordinary glass and able to withstand the impacts of thermal stress resulting from collector start-up and stagnation temperatures. The export price is about $10/m^2$. WRITE: Frank Engle, Pres., AFG International, Dept. CN, P.O. Box 929, Kingsport, Tennessee 37662 U.S.A. Telex: 553436.

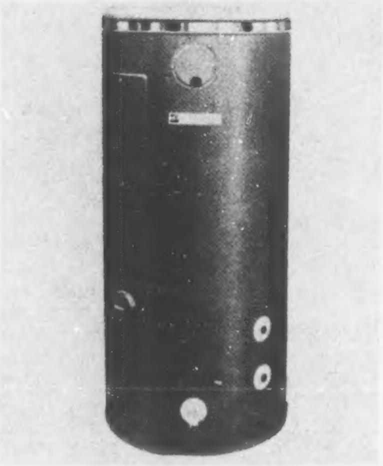


NEW SOLAR HOT WATER CONTROL CONSOLES — Designed for use with open-loop solar hot water systems, this firm's "Solar Control Console" is pre-assembled and engineered to reduce installed system costs. When combined with the solar collector and hot water tank, the console forms a complete solar hot water system. Models offered by the firm feature automatic or manual flow control, hot water service temperature control, freeze protection, and digital display. Agents and distributors are sought for this console, which is compatible with all drainable solar collectors approved for potable water use. WRITE: Mr. Michael E. Fiore, Vice President, Enerdyne Corporation, Dept. CN, Hanover Air Industrial Park, 511-A Whitesel Road, Ashland, Virginia 23005 U.S.A.

NEW HIGH TEMPERATURE SOLAR ABSORPTION COATING — For use by manufacturers of solar heating systems, this firm's new "ATC-301 Solar Absorption Coating" is said to have a high bonding strength to stubborn metals as well as excellent resistance to abrasive chemicals and ultraviolet rays. According to the firm, the "ATC-301" has a 0.97 coefficient of solar radiation absorption and offers high thermal conductivity with operating temperatures of over 205° C. Easy to apply, says the firm, this low cost "ATC-301 Solar Absorption Coating" is priced at $60 per .95-l container. WRITE: Dan Saslow, President, Aerolix Technical Components, Dept. CN, 720 South Columbus Avenue, Mount Vernon, New York 10550 U.S.A.

SOLAR COLLECTOR PROTECTIVE COATING — Manufacturers of flat plate solar collectors can use "Thurmalox 250," a selective black silicone-based heat resistant coating designed for use on aluminium, copper or stainless steel surfaces of collector panels. The coating has a 96 percent solar absorption and a 42 percent infrared emissivity. It is said to resist outgassing to 205° C and to withstand temperatures up to 538° C. According to the firm, "Thurmalox 250" dries for handling in about 15 minutes and is suitable for either air-drying or heat curing processes. It is available in 390-ml fluorocarbon-free spray cans and in industrial containers. Agents and distributors are actively sought. WRITE: Thomas S. Stack, Thurmalox Product Manager, The Dampney Company, Dept. CN, 85 Paris Street, Everett, Massachusetts 02149 U.S.A. Telex: 710-348-6716.





SOLAR WATER HEATER — Home owners, building owners, and solar system manufacturers and distributors can use this firm's new and unique urethane insulated, stonelined "Solar Water Heater". According to the firm, the stonelining permits an immersed finned copper heat exchanger to be used with negligible danger of electrolytic corrosion, said to be a frequent problem with glass-lined tanks. Tanks are available in 151, 246, 302 and 454-l models. Electric backup elements are optional. Claimed to be easy to install, the heater is priced from $200 to $600. WRITE: Ronald F. Cataldo, Product Manager, Appropriate Technologies Department, Ford Products Corporation, Dept. CN, Ford Products Road, Valley Cottage, New York 10989 U.S.A.

EASY TO INSTALL SOLAR HOT WATER HEATER — According to the firm, this "Tropic Solar Water Heater System" is an efficient, inexpensive, and simple new hot water system for residential and commercial applications. The unique passive external heat exchanger, says the firm, uses both conduction and convection to achieve maximum performance at minimum expense in any climate. Priced from $2,000 to $2,800, the "Tropic" has clearly visible dials to facilitate monitoring and requires an area 89 by 89 cm. The heater is said to be easy to install, even by untrained personnel, and requires little maintenance. Agents and distributors are sought. WRITE: Wayne Robertson, Assistant to the President, Sunflower Solar, Inc., Dept. CN, 1864 Sullivan Road, College Park, Georgia 30337 U.S.A.

SOLAR WATER HEATER WITH BUILT-IN BACKUP SYSTEM — This firm's "Gas Assisted Solar Water Heater" is said to be the first commercially available solar water heater with a built-in backup system. The glass lined tank contains a submerged combustion chamber into which the burner and pilot are inserted. Tanks are available in 277 and 437-l sizes and are said to be insulated for maximum heat retention. Potential users include those with residential and commercial solar hot water systems. Bank reference: Ameritrust Company, Cleveland, Ohio. WRITE: Walter L. Abt, Mor-Flo Industries, Inc., Dept. CN, 18450 South Miles Road, Cleveland, Ohio 44128 U.S.A. Telex: 985-496.

VALVE TO CONTROL FLUID FLOW — This firm's "Model No. V-220-Thermal Three-Way Valve" is designed for use by manufacturers and installers of solar energy systems as a bypass valve, directing water depending on temperature. The adjustable valve is available with various elements capable of calibration in ranges from 36° and 82° C to 96° C and from 52° to 74° C. This valve's unique advantage, says the firm, is that it requires no outside energy to accurately blend or direct the flow of fluids. WRITE: Mr. R. J. Smith, Executive Vice President, H & H Precision Products, Division Emerson, Dept. CN, 25 Canfield Road, Cedar Grove, New Jersey 07009 U.S.A.

HEAT PUMP WATER HEATER — This firm's non-reversible, air-to-water vapor compression device, the "Heat Pump Water Heater," may be utilized to heat water up to 60° C with resulting energy savings of 64 to 79 percent, according to the firm. The product converts existing storage type water heaters to the vapor compression system. Complete with interconnecting tubing and fittings, including a pressure-temperature relief valve, the water heater may be installed by homeowners. As the unit is completely self-contained with its own circulator and control thermostat, power to the existing water heater can be completely disconnected, leaving it in a storage function. Home builders and heating, ventilating, and air conditioning contractors are among some of the users for the system priced from $501 to $1,000. WRITE: Harold S. Boxer, Vice President and General Manager, Fedders Company, Dept. CN, Woodbridge Avenue, Edison, New Jersey 08817 U.S.A. Telex: 844-551.

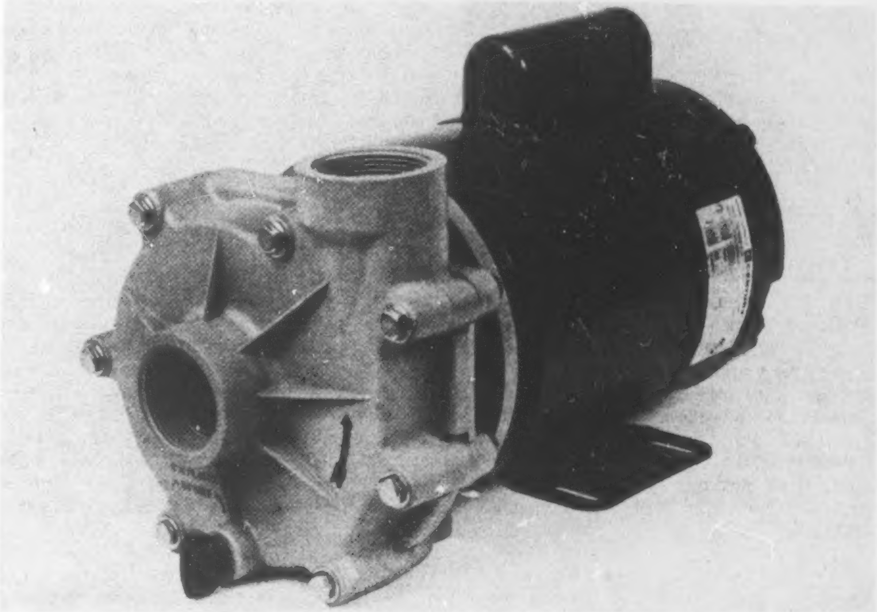
STORAGE SYSTEMS

NEW, PRACTICAL THERMAL STORAGE SYSTEM — According to the firm, "Thermal 81 Energy Rods" provide efficient, practical thermal storage, eliminating the need for large storage containers of rock or water. Working on the phase change principle, the energy rods absorb large amounts of heat as the "Thermal 81" compound melts with no change in temperature. Each rod is said to store 2,460 Btu of latent heat at 27° C, the degree at which phase change occurs. The "Energy Rods" will provide efficient thermal storage, says the firm, for active and passive solar systems, heat pumps, industrial and commercial heat reclamation, and off-peak heating and heat storage for solid fuel burning. WRITE: Stephen Campbell, Marketing Manager, P.S.I. Energy Systems, Inc., Dept. CN, 1533 Fenpark Drive, Fenton, Missouri 63026 U.S.A. Telex: 910 760 1419.

HEAT BATTERY FOR THERMAL ENERGY STORAGE — The "Heat Battery" is a thermal storage system which can store heat for later use in much the same way as a car battery stores electricity. Using a readily available salt solution as the phase change material, the "Heat Battery" is said to store approximately 373 MJ/m^3 at 32° C from any heat source. These can include solar heat and waste heat from air conditioning or refrigeration equipment, burning trash, or industrial processes. According to the firm, the "Heat Battery" can be effectively used by electric utilities in load management and off-peak-load rate utilization and can interface with solar collectors as a storage medium. The export price range is from $2,500 to $10,000. WRITE: Donald W. Barlow, Sr., General Manager, OEM Products, Inc., Dept. CN, 1802 Turkey Creek Road, Plant City, Florida 33566 U.S.A.

FLUID TRANSPORT SYSTEMS

MAGNETIC DRIVE PUMP — The "CP Series Magnetic Drive Pump" provides hot or cold water circulation at a low energy consumption level in solar waste heat reclamation and in heat pump hot water service. The firm says that this pump's graphite bearing system provides minimal wear and requires little or no maintenance. The pump is offered in a wide range of materials and designs for various liquids and temperatures. Solar energy equipment and hot water pump manufacturers and other industries requiring pumps are potential end-users. Overseas representatives are sought for this pump priced from $30 to $40. WRITE: Steve Matthews, Export Manager, Hartell Division, Milton Roy Company, Dept. CN, 70 Industrial Drive, Ivyland, Pennsylvania 18974 U.S.A. Telex: 834348.

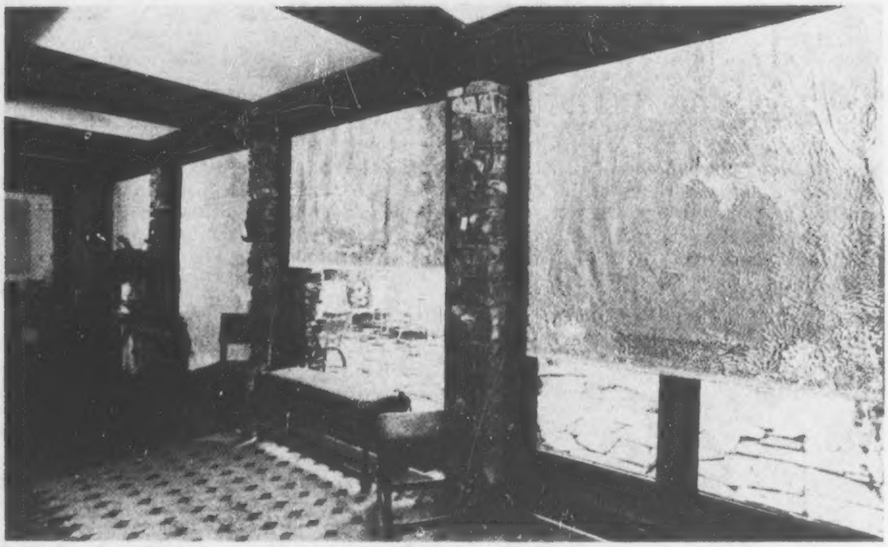


EFFICIENT CENTRIFUGAL PUMP — This low cost "Sequence 1000 Pump" was designed for use in industrial solar applications, particularly as a primary circulating pump. This centrifugal pump is molded of a glass-filled thermoplastic and is available in various capacities. According to the firm, the "Sequence 1000 Pump" has a high tensile and impact strength over a wide range of temperatures, eliminating many of the hazards encountered in normal operating conditions. The pump is said to have a high resistance to most acids, alkalis, and organic solvents. The price range is $230-$500. WRITE: Rod Talley, Vice President/Sales Manager, Multi-Duti Manufacturing Inc., Dept. CN, 2736 E. Walnut, Pasadena, California 91107 U.S.A. (Photo above)

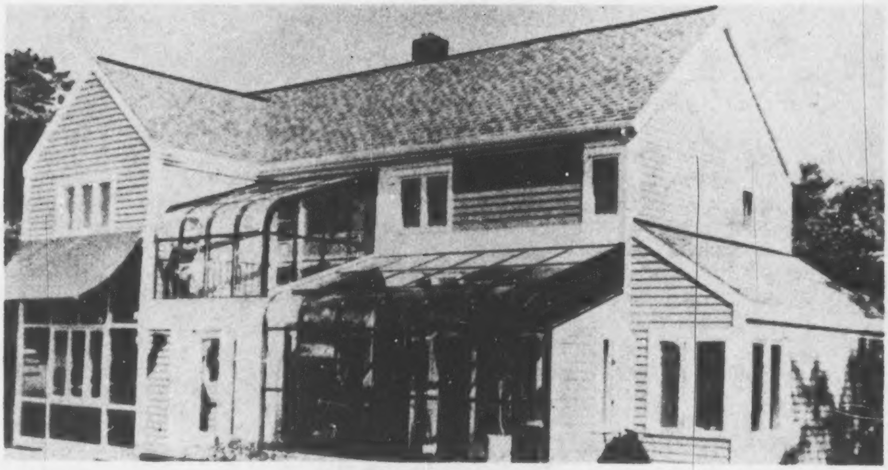
SOLAR DESALINIZATION

SOLAR DESALINIZATION — This firm's "Solar Water Purification" system purifies salt, brackish, or polluted water. Lightweight, portable, and easy to assemble with local materials, this system is said to be ideal for persons and communities in areas with a poor or limited pure water supply. Each water-carrying trough is .6 m wide by 300 m long and supported by wooden A-frames. Storage tanks have a 38,000-l capacity. Consisting of modular units, the system price starts at $400, depending on the size. Agents and distributors are sought. WRITE: Edward H. Dorn, President, The Dorn Corporation, Dept. CN, 1194 Aquidneck Avenue, Middletown, Rhode Island 02840 U.S.A.

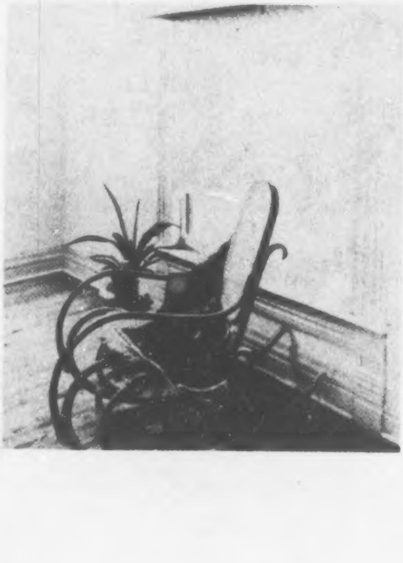
PASSIVE PRODUCTS



INSULATING CURTAIN WALL — This firm's "Insulating Curtain Wall" is said to provide effective thermal insulation for large windows and for solar applications such as trombe walls and greenhouses. Fully automated, the curtain lowers to insulate during cold, cloudy days and to shade during hot summer months. Consisting of four layers of lightweight, reflective materials, the shade inflates to yield an R value between 9 and 12, according to the firm. The curtain's maximum width is 6 m, and it has a maximum height of 4.5 m. It is priced from $53 to $108/m^2. WRITE: David V. Low, Vice President, Thermal Technology Corporation, Dept. CN, Atlas Industrial Park, 600B Alter Street, P.O. Box 682, Broomfield, Colorado 80020 U.S.A.

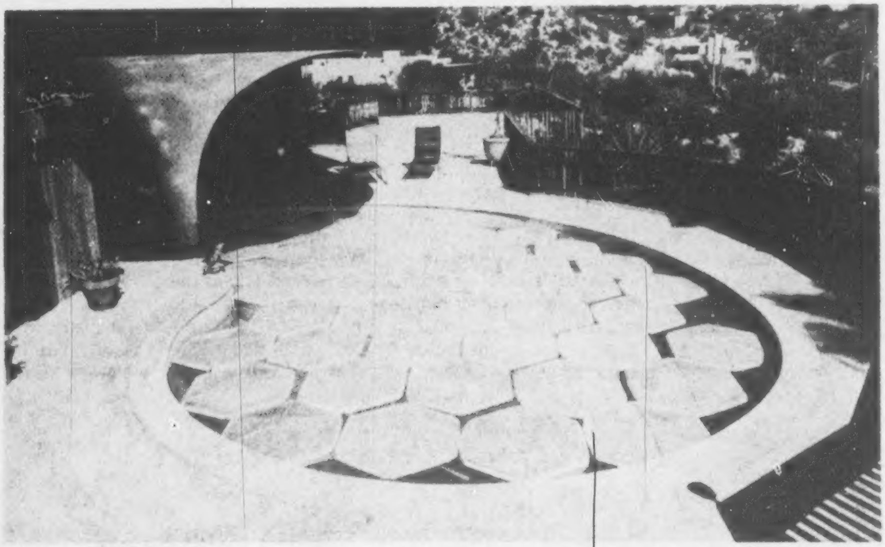


MAINTENANCE FREE SOLAR GREENHOUSE — The "System 3 Solar Greenhouse" room captures and stores solar energy, reducing energy costs, while providing additional space for gardening or leisure activities. Available in a freestanding or lean-to design, the greenhouse is constructed of double or triple insulated panels of tempered safety glass, claimed to be ten times stronger than ordinary window glass. Using a bronze-tone aluminum finish which resists corrosion, the "System 3 Solar Greenhouse" is maintenance free, says the firm. This prefabricated greenhouse can be easily assembled by the homeowner. WRITE: Chris Esposito, Pres., Four Seasons Solar Products Corporation, Dept. CN, 910 Route 110, Farmingdale, New York 11735 U.S.A.



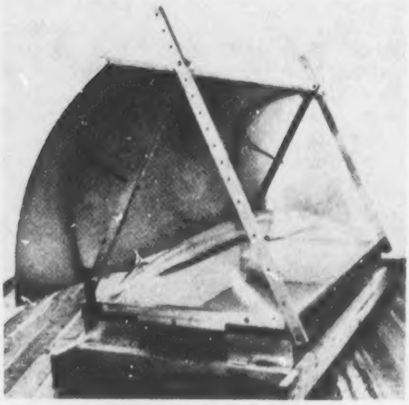
WINDOW QUILT FOR EFFICIENT INSULATION — Homes and office buildings can use the new "Window Quilt" insulating panels to help lower thermostats and reduce heating and air conditioning costs. Consisting of a five-layer sandwich of mylar, fiberfill, and polyester-blend cover fabric, these panels attach magnetically to premounted metal strips on window frames to provide an effective dead air space for insulation. According to the firm, these panels cut heat loss through windows and sliding glass doors up to 79 percent and insulate single glazed windows up to an R valve of 4.25. The "Quilt" is available in four colors and is priced at about $28/m^2. WRITE: Peter Holden, Vice Pres., Mktg., Appropriate Technology Corporation, Dept. CN, P.O. Box 975, Brattleboro, Vermont 05301 U.S.A.

REVERSIBLE DRAPERY LINER PANELS — Homes, hotels, etc., can use "Wind-N-Sun Shield" reversible drapery liners that attach easily on the same rings as the existing drapery. Each aluminized polyester panel is banded to a white vinyl sheet with a fiberglass scrim in between for durability. When the aluminized side is turned towards the glass in summer, it is claimed to reflect 95 percent of the solar heat. Reversed in winter, the liner reradiates furnace heat into the room. According to the firm, an R value of 4 is achieved when liners are used with the roller shade brackets and side-edge sealers. Agents, distributors, and licensees are sought for the product which sells from $12 to $25 a panel. WRITE: Carol Boyle, Pres., Wind-N-Sun Shield, Inc., Dept. CN, 131 Tomahawk, P.O. Box 2504, Indian Harbour Beach, Florida 32937 U.S.A. Telex: 56-4436 COMMARS ORL. Cable: COMMARS.



SEGMENTED POOL COVER — Using the greenhouse effect, "Solar Pool Petals" provide insulated air space between the solar film and water surface insuring heat retention during the night and day. Constructed of durable, floatable plastic, they are lightweight and easily handled, yet will not blow off the pool surface on windy days. Use of the "Petals" is said to increase pool temperatures 5 to 8° C, reduce water evaporation 80 to 90 percent, and lower chlorine usage 50 to 70 percent. The export price is about $1,000 per pool; distributor and licensee inquiries are welcome. WRITE: Loren C. Acker, Pres., Engineering and Research Associates, Inc., Dept. CN, 500 N. Tuscon Blvd., Tucson, Arizona 85716 U.S.A. Telex: 165529. (Photo above)

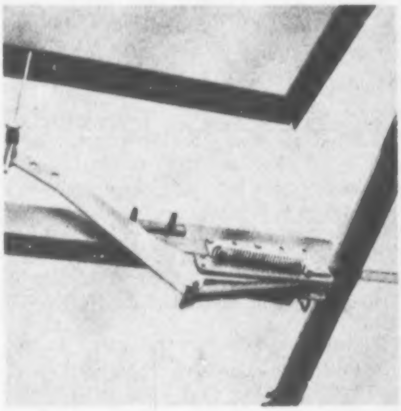
EXTERIOR WINDOW LOUVRES — Domestic, commercial, and public buildings with large windows can use "Solarmatic Exterior Louvres" to reduce air conditioning costs and to protect against wind chill factors during cold months. The louvres are said to operate so that the maximum amount of natural light can enter the building. Mounted on the exterior, the louvres can be manually or electrically operated from the inside. According to the firm, the "Louvres" absorb 92 percent of the solar radiation hitting the building. The price is from $53 to $140/m^2. WRITE: J. C. Maillard, Pres., Joseph C. Maillard Enterprises, Dept. CN, 1233 E. Ramsey St., Banning, California 92220 U.S.A.



SKYLIGHT SUN REFLECTORS — An adjustable, aluminum reflector, the "Sunbender Reflector-Shade" is mounted on skylights and adjusted to shade the skylight from the summer sun and to intercept and reflect low-angle winter sun into the building. The "Sunbender" requires minimal maintenance, says the firm, and will withstand considerable wind loads. Available in widths up to 3.4 m, the "Sunbender" is 105 cm high and equipped with mounting struts and brackets for installation. The export price range is from $250 to $450. WRITE: Mr. Steve Baer, President, Zomeworks Corporation, Dept. CN, P.O. Box 712, Albuquerque, New Mexico 87103 U.S.A.

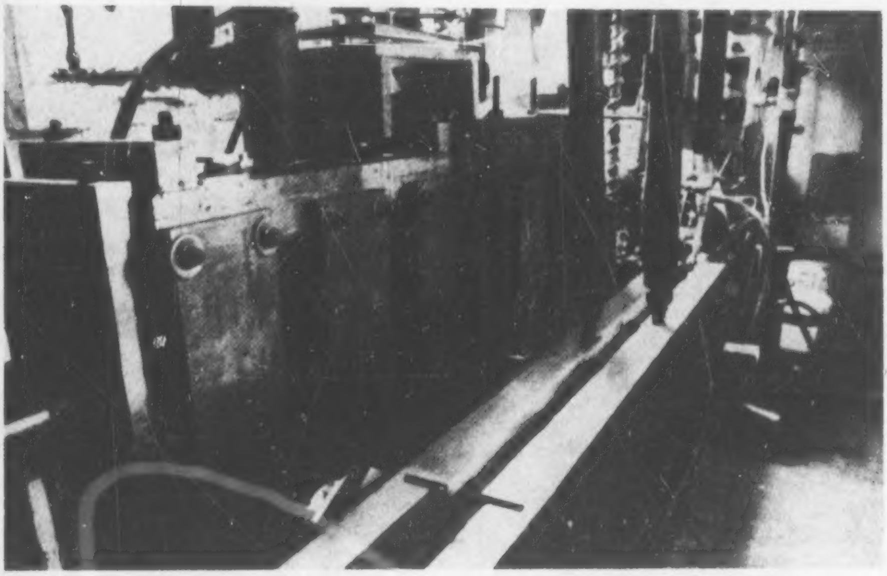
NEW SOLAR GREENHOUSE — According to the manufacturer, the "Sunplace Solar Greenhouse" is designed as a highly efficient solar collector, providing solar heat to either new structures or existing ones and creating a functional living space. Lightweight for easy installation, the "Greenhouse" is composed of modular units which can be combined until the desired size is attained. In addition to aluminum, glass, and acrylic components, the "Greenhouse" contains integral thermal storage, moveable insulation, and a computer-controlled heating system. An advantage of this "Greenhouse" listed by the firm is its strength, said to be two to three times stronger than others commercially available. The price begins at $5,000. WRITE: Bill Yanda, President, Sunplace Corporation, Dept. CN, P.O. Box 237, Hinesburg, Vermont 05461 U.S.A. (See back cover).

NEW SOLAR POWERED GREENHOUSE WINDOW VENTILATOR — This firm's "Solarvent" protects greenhouse plants from sudden temperature changes or electric power failure. "Solarvent" operates on a thermal power pack that opens greenhouse vents hydraulically. When the temperature of the air surrounding the vent rises, the heat-sensitive material in the unit expands and moves a series of rods and arms, opening the vent. This unique, low-cost system is said to be maintenance-free and can be installed in only about 15 minutes. Potential users include greenhouse manufacturers and distributors and homeowners. The price ranges from $6 to $25. WRITE: W. A. Felknor, Director of Marketing, Dalen Products, Inc., Dept. CN, 201 Sherlake Drive, Knoxville, Tennessee 37922 U.S.A.



TRANSPARENT FILM FOR HEAT CONTROL OF BUILDINGS — Schools, offices, buildings, and factories can use "Therm-O-Lux," a transparent solar reflecting film that is said to keep out up to 85 percent of the sun's radiant heat, reducing air conditioning costs, while letting light in. During winter, radiant heat loss is reflected back into the building. This "Therm-O-Lux" film is said to adhere easily to glass surfaces without chipping, cracking, or flaking; it also is said to strengthen glass, making it shatterproof. The manufacturer is actively seeking overseas distributors for this windowshield available in various size rolls. Bank reference: Old Colony Bank, Burlington, Massachsuetts. WRITE: Allan G. Bowry, President, Therm-O-Lux International, Inc., Dept. CN, 45 Winn Street, Burlington, Massachusetts 01803 U.S.A. Cable: TXINT.

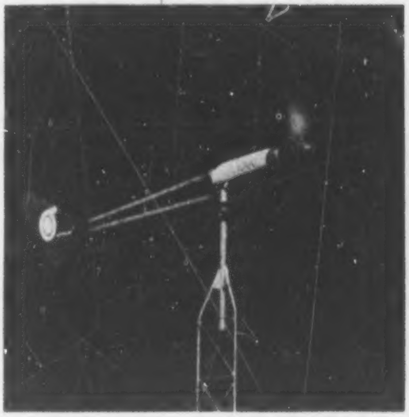
OCEAN THERMAL ENERGY CONVERSION



NEW HEAT EXCHANGER — This firm has developed a new "Flat Plate Heat Exchanger" for use in ocean thermal energy conversion (OTEC) plants. This heat exchanger is said to perform more efficiently with a smaller volume and pressure drop than other heat exchangers proposed for OTEC plants. According to the firm, advantageous features include design flexibility, easy manufacturing and cleaning processes, and reduced pumping requirements. The "Heat Exchanger" can also be used in refrigeration, air conditioning, and other Rankine cycle applications. Licensee inquiries welcome. WRITE: James H. Anderson, Jr., Vice President, Sea Solar Power, Inc., Dept. CN, 2422 South Queen Street, York, Pennsylvania 17402 U.S.A.

WIND ENERGY SYSTEMS

DURABLE, LOW COST WIND POWER MACHINE — For use by residential energy users or those seeking power in remote sites, the "BWC Wind Power Machines" are designed for high reliability, low maintenance, and automatic operation in all weather conditions, according to the firm. Rated at 1,000 W at 11 m/s, these units are available with either an advanced synchronous inverter or a complete battery-charging system. The low speed alternator does not require a gear box, and the "Powerflex" rotor system provides variable pitch performance with fixed pitch simplicity. These machines are said to withstand wind speeds up to 54 m/s. At wind speeds above 13 m/s the "Autofurl" tail turns the rotor out of the wind until it subsides. Treated to prevent rust and corrosion, this machine retails at $2,500-$3,000. WRITE: A. Farrel Droke, Proj. Engineer, Bergey Windpower Company, Inc., Dept. CN, 2001 Priestley, Norman, Oklahoma 73069 U.S.A.



NEW, DIRECT DRIVE WIND ELECTRIC GENERATOR — This firm's direct drive "Sky Hawk" wind electric generator is designed for utility tie-in situations, as a stand-alone system in remote or isolated areas, or in salt water environments. Because the direct drive model uses no belts or gears, maintenance is said to be easy while generator operation is efficient and reliable. The average operating speed is 160 rpm. An automatic shut-down and turn-on in high winds is available. A pitch change adjustment in the blades that relieves stress, prevents storm damage, and maintains rpm's in high winds, is a standard feature of the "Sky Hawk," along with an aluminum nose cone and zinc chromate primer finish. This wind energy generator is available in 2,000 and 4,000-W models from $6,000 to $9,000. WRITE: Mr. George D'Angelo, Vice President, Independent Energy Systems, Inc., Dept, CN, 113 E. 13th Street, Erie, Pennsylvania 16503 U.S.A.

CONSTANT SPEED WIND ELECTRIC GENERATOR — Ideal for use by farmers, small manufacturers, and consumers in isolated stations and homes, this firm's "Wind Electric Generator" is said to withstand winds up to 27 m/s. With the generator located on the ground, rather than mounted behind the fan, a less massive tower structure is required. Generator controlled prop speed enables the wind generator to run at a constant speed even in high winds. The price ranges from $4,800 to $25,000. WRITE: Cecil L. Moore, President, Engineers, Ltd., Dept. CN, 823 Central Avenue, Dubuque, Iowa 52001 U.S.A.

SMALL WIND ENERGY CONVERSION SYSTEM — Isolated residences are potential end-users of this "Small Wind Energy Conversion System" (SWECS) with a horizontal axis and a three-bladed, downward variable pitch 4 kW rotor that is 945 cm in diameter. Fabricated of E-Glass fiber/polyester resin, this system is said to offer a low cost, durable alternative to conventional energy sources. Coated with a polyurethane paint to resist corrosion, the SWECS, says the firm, produces from 7,500 to 14,000 kW hr/year at a mean annual windspeed of 4.5 m/s and can withstand peak gusts of 56 m/s. According to the firm, the composite, lightweight tower structure allows for a higher strength-to-weight ratio than comparable steel towers. WRITE: Vicki Morris, Marketing Engineer, Structural Composites Industries, Inc., Dept. CN, 6344 North Irwindale Avenue, Azusa, California 91702 U.S.A.

VERTICAL AXIS WIND ENERGY GENERATOR — The "Cycloturbine Wind Machine Model C2E3" is a straight bladed, self-starting, vertical axis electrical wind generator. This model is said to be unique because it accepts wind from all directions by means of a tailvane affixed to the cam device atop the mainshaft. In winds above 25 m/s, an automatic brake is activated, and the machine will not self-start until the winds recede. The machine can be adapted for direct tie-in with the utility grid, as an alternator or generator for resistive heating, as a battery system for remote site power, or for translating mechanical energy to an air compressor, water pump, etc. The price is about $15,000. WRITE: Gregg Amonette, Mktg. Mgr., Pinson Energy Corporation, Dept. CN, P.O. Box 7, Marston Mills, Massachusetts 02648 U.S.A.

RELIABLE WIND SYSTEM MAXIMIZES PERFORMANCE — The "HR 2 Wind Electric System" is said to deliver a reliable power supply, even under harsh environmental conditions, to remote sites. The system's unique variable axis rotor control system (VARCS) minimizes the number of moving parts and provides maximum reliability with minimum maintenance. The VARCS combines overspeed control, high wind shutdown and reset, and manual shutdown for maintenance in one control mechanism. The 5-m, 3-blade turbine directly coupled to the slow speed generator produces 2,200 W at 9 m/s and maintains a 700 W continuous load with average winds of 5.4 m/s. Agents, distributors, and licensees are sought for this $9,000-$15,000 product. WRITE: Donald Mayer, Vice Pres., North Wind Power Company, Inc., Dept. CN, P.O. Box 315, Warren, Vermont 05674 U.S.A. Telex: 940933.

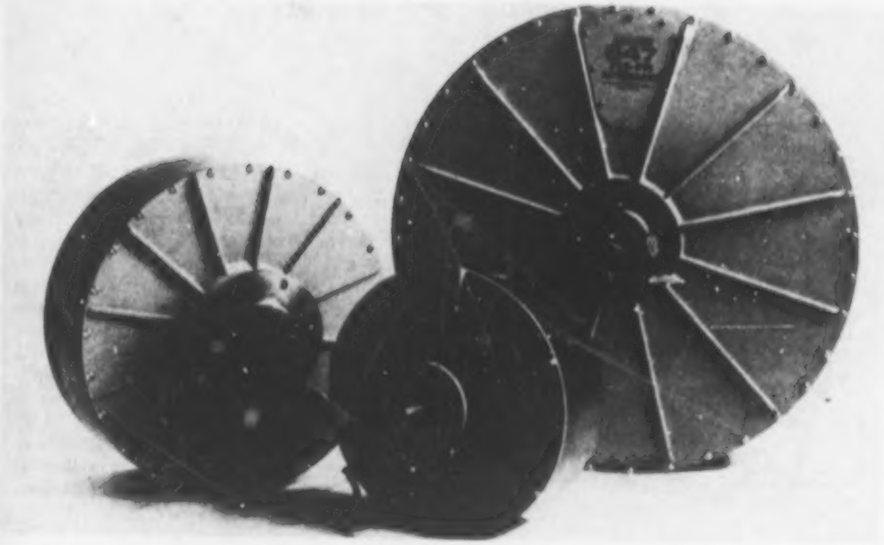
PROTECTIVE DEVICE FOR SHUT-OFF CABLES — Manufacturers and owners of wind turbine generators can use this firm's "Piroutte Torsion Limiter" to protect the shut-off cable from accumulating excess torsion due to changing wind directions. Without the "Limiter," the cable from the wind turbine generator to the base of the tower will twist and fail to function, says the firm, as the turbine yaws to follow the wind. This low friction device is corrosion proof with sealed ball bearings. The cost is $15. WRITE: Sherret Chase, Pres., Wind, Wood, and Water Company, Dept. CN, P.O. Box 193, Shokan, New York 12481 U.S.A.

HIGH RELIABILITY — This firm's "Starlite SL 1500 Wind Powered Generator" offers 12, 24, 32, 48, and 110-V d.c. output power for remote site electrical needs. It has a 360-cm rotor and generates 1,500 W at 15 m/s, enough electricity to power an energy efficient home. Any power generated above that being used is stored in the batteries for when there is no wind. Power can be supplied by winds as low as 4 m/s. The company says this machine requires little maintenance and is a reliable power supplier in harsh climates. Distributors, licensees, and joint venture agreements are sought for this $3,300-$4,000 machine. WRITE: Mario Agnello, Pres,, Aero Power Systems, Inc., Dept. CN, 2398 Fourth St., Berkeley, California 94710 U.S.A.

MONOTUBE TOWER FOR WIND TURBINE GENERATORS — Wind turbine generator buyers and dealers can use this firm's "Monotube Tower," an easily erected, cost effective support system. The firm offers towers measuring 12 m and higher. For example, explains the firm, the 12 m model supports 270 kg and will withstand a lateral load of 405 kg with a maximum deflection of 8°. The tower is shipped in four sections, the longest being 5.1 m. One person can raise the sections into their positions by use of a gin pole, according to the firm. All wiring is internal and removable legs on the tower provide easy access to the top. The price ranges from $1,500 to $5,000 depending on size. WRITE: Bror Hanson, President, Solargy Corporation, Dept. CN, 17914 East Warren Avenue, Detroit, Michigan 48224 U.S.A.

VERTICAL AXIS WIND GENERATOR — The "Windmule" is a stored-power electrical generating system using a modified savonious rotor and a 180-V d.c. storage battery system. The storage capacity is 12 kW/hr at 125-V a.c. 60 Hz, and the 60 Hz system can be easily converted to 50 Hz. The rotor is said to produce 3 to 3.5 kW in winds of 4.5 m/s to 5.4 m/s and is self-feathering in winds more than 21.5 m/s. The steel tower is in 25.4 cm sections with a self-erecting capability for easy on-site assembly. The "Windmule" produces electrical power for agricultural, remote site uses, etc. The price range is from $12,000 to $14,000. WRITE: Bob Thornberg, Communications Director, Solargizer, Dept. CN, 2010 West 98th Street, Bloomington, Minnesota 55431 U.S.A.

WIND GENERATED ELECTRICITY — Farmers, homeowners, and small commercial businesses can reduce their electricity costs with this new horizontal-axis "Enertech 1800 Windmachine". Generating 110-V, 60-cycle power that interconnects directly with the electrical utility grid, the windmachine is able to feed wind generated electricity into the grid in times of surplus generation. Conversely, the utility automatically and instanteously compensates for any shortage in electrical demand not satisfied by the windmachine, explains the firm. The control system de-energizes the generator and applies the brake in winds above 17.9 m/s or below 3.6 m/s. The machine will shut off during power failures and eliminate any danger of "backfeeding" a broken utility line. Dealers are sought for this $4,500-$5,000 windmachine. WRITE: Edmund Coffin, Chairman, Enertech, Dept. CN, River Road, P.O. Box 420, Norwich, Vermont 05055 U.S.A.



ALTERNATOR FOR DIRECT DRIVE WIND ENERGY SYSTEMS — This "Very Low Speed, Permanent Magnet (VLS-PM)" alternator is designed specifically for direct drive wind system applications, eliminating the need for a gearbox. According to the firm, the low operating speeds make it ideal for such applications, avoiding the efficiency losses and maintenance problems associated with gearing. Three different sizes, from 1.5 kW to 15 kW, are available for wind energy system manufacturers and researchers. The export price begins at $700. WRITE: Willard D. Gillette, President, Zephyr Wind Dynamo Company, Dept. CN, P.O. Box 241, 21 Stanwood Street, Brunswick, Maine 04011 U.S.A.

WIND SYSTEM REDUCES UTILITY COSTS — This firm's three bladed up-wind turbine generator, the "Millville Model 103-IND," is said to be an ideal supplement to residential or industrial electrical systems, reducing utility costs. The 240-V, 42-amp, 60-cycle a.c. induction generator produces 10 kW at 11 m/s. Advantages listed by the firm include automatic phasing with line voltage, standard 3-phase winding (single phase winding is optional), and low maintenance design. A self-furling tail protects the "Mill" from damage due to severe wind gusts or unexpected high winds. The price is $12,000. WRITE: D. R. Tassen, Pres., Millville Windmills, Inc., Dept. CN, 10335 Old 44 Dr., Millville; California 96062 U.S.A.

LOW-HEAD HYDRO SYSTEMS

NEW DESIGN FOR LOW-HEAD HYDRO SITES — Rural areas with low-head sites can use this firm's newly designed "Hydro Electric Turbine" to obtain maximum power from those streams previously regarded as having little potential. The engineering design, explains the firm, uses "runners" to obtain the optimum pitch from the blades, improving the efficiency of low-head streams to 80 and 87 percent. According to the firm, the "Hydro Electric Turbines" are simply constructed for easy operation. The export price ranges from $25,000 to $1 million. WRITE: Thad N. Schott, Area Marketing Manager, The James Leffel and Company, Dept. CN, 426 East Street, Springfield, Ohio 45501 U.S.A. Telex: 205-419.

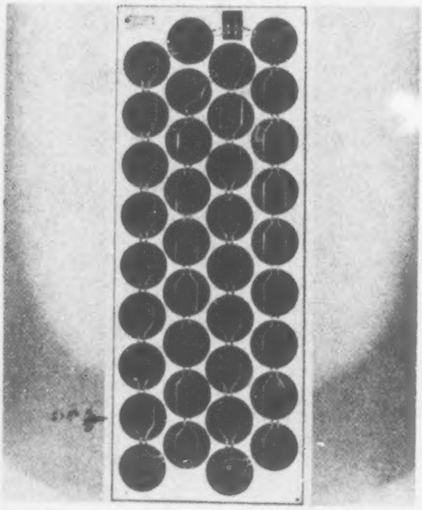
PHOTOVOLTAIC PRODUCTS AND SYSTEMS

SOLAR POWERED EVAPORATIVE COOLER — This firm's "Evaporative Cooler" is said to provide fresh, cool air for the home or office. Consisting of two fan systems, the unit runs quietly and can cool approximately 111 to 121 m^2. Back-up power is provided by 12-V batteries charged by the two solar cell panels mounted on the roof. The cabinet is a heavy duty metal with a baked on enamel finish. According to the firm, this is a quiet and long lasting cooler whose fan blades are balanced for quietness and efficiency. The price is $2,500. WRITE: John T. Foley, Sales Manager and Representative, William Lamb Company, Dept. CN, 1138 W. Townley Avenue, Phoenix, Arizona 85021 U.S.A.

PORTABLE SUN PUMP — The "SEI-250 Sun Pump," a portable, self-contained pumping unit, can handle the low-lift irrigation requirements of small farmers (1-4 ha) in rural areas and in other places not served by an electric grid. The unit incorporates a 250-W photovoltaic array, a submersible pump directly coupled to a low-voltage, brushless d.c. motor, and a maximum power control unit mounted on a sturdy, wheeled trolley. According to the firm, the "Sun Pump" yields 2.5 l/s at a lift of 4.5 m. The export price is $6,000. WRITE: Theodore K. Osgood, Director, Solar Electric International, Dept. CN, 4837 Del Ray Avenue, Washington, D.C. 20014 U.S.A. Telex: 248491.

SINGLE-CRYSTAL SILICON — This firm produces square-shaped, single-crystal silicon bars or wafers for photovoltaic applications in 5 by 5 cm or 10 by 10 cm sizes. The silicon is directionally solidified into ingots using the firm's unique Heat Exchanger Method. According to the firm, this method produces a high power density silicon cell with a high sunlight conversion efficiency comparable to that presently achieved by semiconductor wafers and substantially higher than the efficiency achieved with polycrystalline casting processes. Potential users include producers of photovoltaic systems. WRITE: Frederick Schmid, Pres., Crystal Systems, Dept. CN, 35 Congress St., Salem, Massachusetts, 01970 U.S.A. TWX: 710-347-1523. Cable: CRYSTALSYS.

SOLAR MODULES FOR DIRECT CONVERSION OF SUNLIGHT — The specialty modules manufactured by this firm can meet individual needs for electricity. Some uses include navigational aids and radio and microwave repeater applications. Priced from $10 to $20 per W, the circular solar cells range in size from .5 by .5 cm to 100 mm and the power output of the modules ranges from 1 to 35 W. Constructed of all glass surfaces on both the front and back, these modules are said to offer maximum resistance to most chemicals, salt water, and humidity and pose minimal expansion and contraction problems. The aluminum frames are easily bolted or riveted together for field arraying. WRITE: Robert W. Willis, President, Solenergy Corporation, Dept. CN, 171 Merrimac Street, Woburn, Massachusetts 01801 U.S.A.

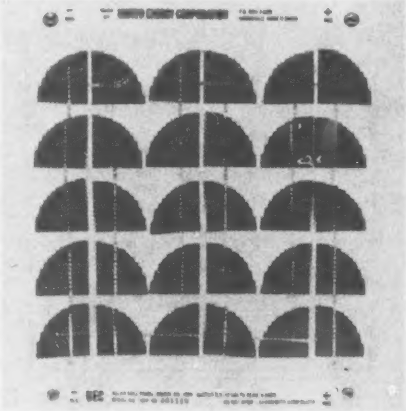


SOLAR ELECTRIC GENERATOR MODULES — These "G12-361 Solar Modules," the firm explains, have been engineered to provide a continuous, reliable electric power source in a variety of applications and environments. They are said to withstand a wind loading capacity of 280 k/h. The unique construction and packaging method is also said to provide harmonious expansion and contraction, even in severe temperature fluctuations. The rear surface is protected by a white polyester backing for improved module efficiency. Designed with efficient light gathering and corrosion resistant electrical contacts, the cells are connected in series or parallel and feature completely redundant cell-to-cell stress relieved interconnects. The price ranges from $499 to $529. WRITE: Anne McNamara, Mktg. Services, Solar Power Corporation, Dept. CN, 20 Cabot Road, Woburn, Massachusetts 01801 U.S.A. Telex: 7103480602.

SOLAR POWERED ATTIC FAN — Powered by a photovoltaic panel, this firm's "Solar Powered Attic Fan" provides an inexpensive way to cool attic spaces and help reduce home cooling costs. The automatic thermostat control switches the fan on when attic temperatures reach 26° C. Unlike conventional electric fans, this "Solar Powered Attic Fan" requires no electrical connections and can be installed by the homeowner. According to the firm, this high pitch fan runs at a low speed for more efficient and long-lasting operation. WRITE: Clyde Wagner, President, Solar Electric Engineering, Inc., Dept. CN, 438 W. Cypress Street, Glendale, California 91204 U.S.A.

PHOTOVOLTAIC POWER PANEL — This firm offers the "SSP-1500 W-12-V Power Panel" to meet a variety of individual electrical needs and requirements. The large 76 cm^2 area panel can be used for any application requiring 12 V. Potential uses include electrical supply for water pumping, fence charging, radio and television repeater stations, appliances in recreational vehicles, etc. According to the firm, the photovoltaic modules have been designed to operate and endure severe thermal and physical shock and to resist moisture and abrasion. Minimum maintenance is said to be required for these long-life cells. WRITE: R. L. Bachner, Silicon Sensors, Inc., Dept. CN, Highway 18 East, Dodgeville, Wisconsin 53533 U.S.A. Telex: Solarcell.

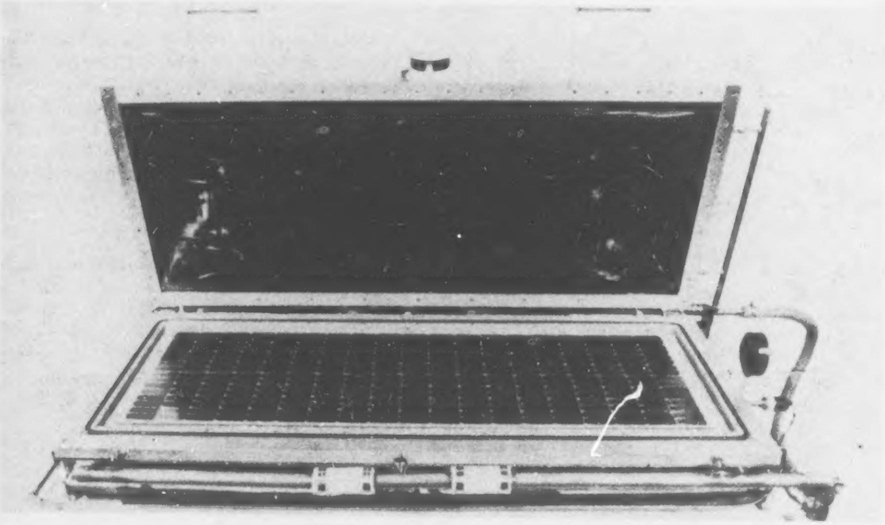
PHOTOVOLTAIC PANELS — This firm's "UEC Photovoltaic Panel" can provide electricity from sunlight for boats, recreational vehicles, and areas far from power grids. According to the firm, these panels can withstand water, salt, and corrosion. In addition, the plastic substrate and prism lens are said to resist ultraviolet rays. Stainless steel bolts are used for the external connections. The cells are encapsulated in a special silicone gel, which is said to achieve light transmittance of 95 percent. The price ranges from $175 to $487. WRITE: Bill Edwards, Vice President, United Energy Corporation, Dept. CN, 666 Mapunapuna, Honolulu, Hawaii 96819 U.S.A. Cable: UECORP.



D.C. TO A.C. POWER INVERTER — This firm's new "6 KW DC to AC Power Inverter" is said to be specifically designed for renewable energy systems using the wind and photovoltaics. Power stored in batteries is converted into a.c. power of the desired voltage and frequency. Advantages of this "Inverter" listed by the firm include the low cost per kW, highly efficient operation, and an optional sine wave output. Distributors are sought for the "6 KW DC to AC Power Inverter" priced from $2,100 to $2,700. WRITE: Jerry Gershenberg, President, Advanced Energy Corporation, Dept. CN, 14933 Calvert Street, Van Nuys, California 91411 U.S.A.

SOLAR POWERED REFRIGERATOR — Specifically designed for the storage and delivery of vaccines in areas not tied to an electrical grid, this "Model RHC-100 Solar Powered Refrigerator/Freezer System" can be used by health officials and remote health care clinics. The "RHC-100" system consists of a refrigerator and freezer section, batteries, photovoltaic controls, solar electric panels, and the necessary mounting hardware and interconnecting wiring harnesses. According to the firm, the photovoltaic system assures adequate power in most site locations, and the batteries are said to provide up to 10 days of "no-sun" storage. The export price is $5,000. WRITE: Brian Kennedy, Manager, Market Development, Solarex Corporation, Dept. CN, 1335 Piccard Drive, Rockville, Maryland 20850 U.S.A. Telex: 248-359SOLX. Cable: Solarex.

PHOTOVOLTAIC MODULE LAMINATOR — According to the firm, this "Spi-Laminator" is designed specifically for efficient and reliable lamination assembly of photovoltaic modules and is capable of using advanced materials such as ethylene vinyl acetate to encapsulate module substrates and superstrates. The "Spi-Laminator" can be used with any solar cell and interconnect configuration, says the firm, and can process modules up to 120 by 40 cm. The export price is $25,000. WRITE: Thomas E. Wilber, Vice President, Spire Corporation, Dept. CN, Patriots Park, Bedford, Massachusetts 01730 U.S.A. Telex: 951072. Cable: SPIRECORP.



SOLAR VENTILATION SYSTEM — The "Solar Ventilation System" distributes air and provides ventilation without raising utility bills. Consisting of an efficient d.c. motor fan directly coupled with a photovoltaic power module, the system ventilates with as little as 25 to 40 percent sunlight and provides maximum ventilation/cooling on hot, sunny days. During cooler seasons, it provides condensation control. Potential uses include attic cooling, livestock and grain storage ventilation, solar air heating systems, etc. Engineered for long, trouble-free maintenance, this system can be easily installed. The price starts at $300. WRITE: George Lacey, Director of Marketing, Photowatt International, Inc., Dept. CN, 2414 West 14th Street, Tempe, Arizona 85281 U.S.A.

EFFICIENT AND RELIABLE STATIC INVERTER — According to the firm, this "M Series Inverter" incorporates the latest solid state electronic development to produce a powerful, efficient, reliable, and serviceable static inverter converting direct current from a storage battery to an alternating current. This "Inverter" is said to deliver four times the surge power to start and run a.c. motors, wind systems, photovoltaic systems, etc., while operating at 90 percent efficiency to preserve battery energy. Ten models are available with output ranging from 600 to 12,000 W, 12 to 140-V d.c., and 50 or 60 Hz. Easy to install and repair, the inverter is $1,000-$8,000. WRITE: T. D. Paul, Pres., Best Energy Systems, Dept. CN, P.O. Box 280, Necedah, Wisconsin 54646 U.S.A.

BIOMASS SYSTEMS

ENERGY FROM WASTES — Small communities, lumber mills, and food processing industries are some of the potential end-users of this "Gasifier" which generates energy from agricultural and forest waste as well as from low-grade mineral fuel, such as peat moss. The resulting gas can be substituted for oil, propane, or natural gas in existing boilers, dryers, furnaces, or kilns. It can also be used in reciprocating internal combustion engines for mechanical power or electrical energy. The export price range for the "Gasifier" is $200,000 to $1 million. WRITE: Scott N. Randall, President, Biomass International Corporation, Dept. CN, 44 Montgomery Street, San Francisco, California 94104 U.S.A.

LOW COST WOOD HEAT FURNACE — This "Longwood MK II Wood Furnace" can be used as an independent wood furnace or as a supplement to an existing forced air furnace. The advantages of this furnace, according to the firm, are its ability to accept wood up to 81 cm long, a thermostatically controlled combustion air damper to minimize heat overrun and maintain room temperatures, and an automatic 21 m^3/min direct drive blower for air circulation. A secondary heat exchanger and a bypass damper are said to obtain maximum heat from the wood. The export price ranges from $1,000 to $1,200. WRITE: Mark McBee, Sales Manager, Longwood Manufacturing Corporation, Dept. CN, P.O. Box 223, Gallatin, Missouri 64640 U.S.A.

ANAEROBIC DIGESTION SYSTEM — Large agricultural facilities with confined livestock can use the "Energy Harvest System" to generate biogas fuel for engines, boilers, furnaces, etc. This system's advantage, as stated by the firm, is the "plug flow" design which is said to result in a 50 percent higher yield than conventional complex mix systems. The company also says that this low cost system is cost-effective where electricity is 5¢ per kW/h or more. The price is $75,000-$250,000. The firm is seeking licensees. WRITE: Bernard C. Nagelvoort, Pres., Energy Harvest, Inc., Dept. CN, 1735 I St., N.W., Suite 602, Washington, D.C. 20006 U.S.A. Telex: 197635.

FUEL REFINERY FOR PROCESSED BIOMASS — Vegetable processing and forest products companies are potential customers of this complete refinery which is capable of converting biomass wastes to a clean, efficient fuel source suitable for burning in place of fossil fuels. Equipment is included to grind, dry, and pelletize any type of biomass feedstock such as wood, tree bark, wheat straw, corn stalks, or peanut hulls. The finished pellet is 9.5 mm in diameter by 25.4 mm in length with a density of 275 kg/m^3 and a heat value of 3,180 to 3,630 Btu/kg. The pellets can be burned in most fireplaces, wood stoves, or furnaces. The export price is $6-10 million. WRITE: Darrell Gentry, Asst. to the Pres., Guaranty Fuels, Inc., Dept. CN, P.O. Box 748, Independence, Kansas 67301 U.S.A.

BOILER FOR WOOD WASTE PRODUCTS — Office, residential, and commercial buildings and industrial plants are potential end-users of this firm's "Federal Boiler" which burns wood and wood waste products for steam or hot water. The boiler is an all steel unit with water walls around the combustion area, which, the firm says, eliminates the need for firebrick and gives a more efficient heat transfer. Air is introduced from below cast iron grates for primary combustion and heated secondary air enters through an adjustable opening in the loading door. As a result, says the firm, complete combustion of flammable gases produced in the firebox is achieved. Nine sizes are available with wood output ratings of 420,000 to 1,428,000 Btu. The export price is $3,000-$8,000. WRITE: Fred C. Johnson, Vice President Sales, Federal Boiler Company, Inc., Dept. CN, 277 Fairfield Road, Fairfield, New Jersey 07006 U.S.A.

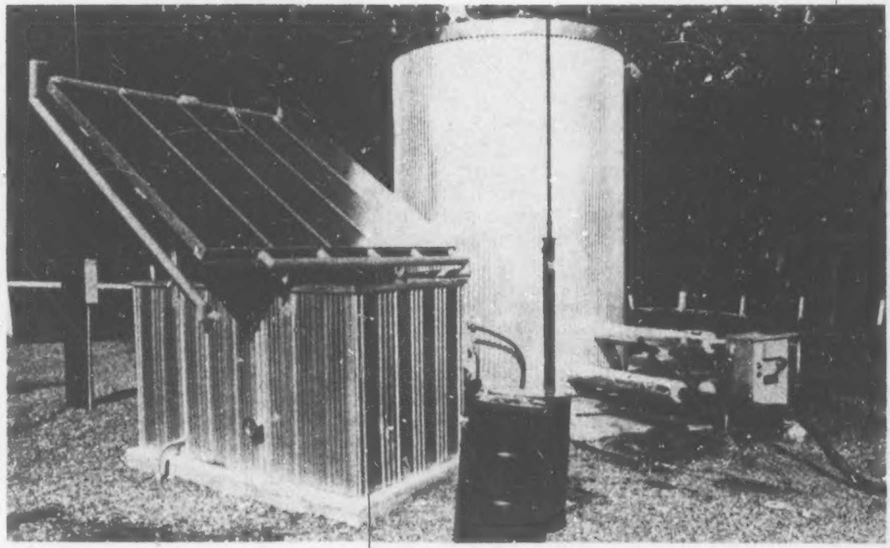
GASOHOL PRODUCTION — The "PEC Process" for producing gasohol is designed to use a large range of carbohydrate feedstock. A positive energy balance is achieved in this process, explains the firm, by utilizing by-products with minimal damage to their food value at a minimum input of energy. By-products include meal for human consumption, corn oil, animal feed, and fodder yeast. Thermal energy used in dissolving starches is minimized through the use of thermocompression at the distillation stage. This new method is said to reduce steam consumption through heat recovery by about 65 percent, compared to conventional methods. End-users include farm cooperatives, food processing and petrochecmical industries, etc. WRITE: Mr. Rene F. Loser, Vice Pres. and Chief Exec. Officer, Chemapec, Inc., Dept. CN, 230 Crossways Park Drive, Woodbury, New York 11797 U.S.A. Telex: 144698.

FUEL PLANT FOR FOOD PROCESSING AND ALCOHOL PRODUCTION — Constructed on three trailer truck beds for easy transportation to the site, this firm's "Agrihol Fuel Plant" produces both alcohol fuel and high protein feed stock from a variety of starchy grains and root crops. The system uses extrusion cooking to minimize water needs and to accelerate conversion from starch to alcohol. Entirely enclosed and constructed of stainless steel, the distiller produces a high grade protein source which can be consumed by humans, as well as by livestock, says to the firm. This $800,000 system is equipped with computer controls for reprogramming by telephone to the United States. WRITE: Bob Thornberg, Communications Dir., Agrihol, Div. of Solargizer Inc., Dept. CN, 2010 W. 98th St., Bloomington, Minnesota 55431 U.S.A.

ALCOHOL STILL — "Innovator Alcohol Stills" have been designed for alcohol production from starch and sugar crops with a high protein feed recovery. The durable, small-scale "Alcohol Stills" are said to be easy to operate with system tank sizes ranging from 190 to 1,900 l/day. Potential users include large farms, cities, etc. Distributor inquiries are invited for these stills. The price begins at $1,500. WRITE: Vernon P. Hein, Sales Manager, Industrial Innovators, Inc., Dept. CN, P.O. Box 387, Plaza Shopping Center, Highway 84, Ashford, Alabama 36312 U.S.A.

EFFICIENT AND EASILY INSTALLED WOODSTOVE — Homeowners, apartment dwellers, and small businesses are some of the potential end-users of the "Concept II" wood heater. This highly efficient heater can be installed as a supplemental or primary heat source in an existing fireplace or as a free standing stove. The airtight construction of heavy-gauge steel and a cast iron, gasketed door is said to provide efficient combustion. According to the firm, installation is easy, requiring no special tools or alterations. The firebox accepts up to 61-cm long logs and a mica viewing window is provided. The export price is $425. WRITE: Richard Connelly, Pres., C.E.M.I., Dept. CN, P.O. Box 290, Ashland, Ohio 44805 U.S.A.

INDUSTRIAL PROCESS HEAT



SOLAR ASPHALT PLANT — Asphalt producers are potential users of this firm's new "Sunpaver" system which uses the sun's energy to heat and maintain asphalt. Incorporated into existing equipment, the "Sunpaver" heats two types of liquid asphalt (RC 2 and RC 70) and emulsion (Catyonic) for tar and gravel of roads, repair of pot holes, and sealing roads. According to the firm, the "Sunpaver" is maintenance free with no moving parts to wear out and will heat tar and asphalt up to 93° C. The price is $15,000-$20,000. WRITE: Thomas Darnell, Sales Mgr., Virginia Solar Components, Inc., Dept. CN, Highway 29 South, Rustburg, Virginia 24588 U.S.A.

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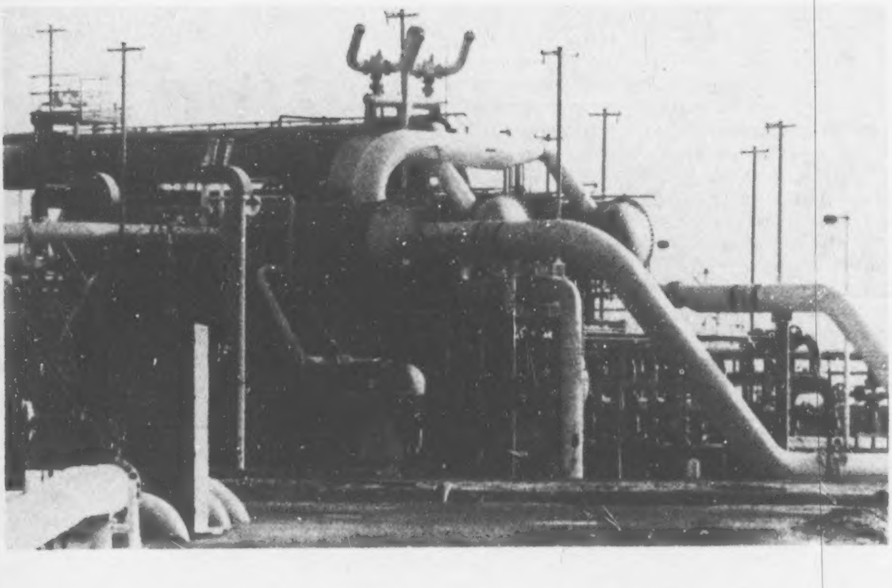


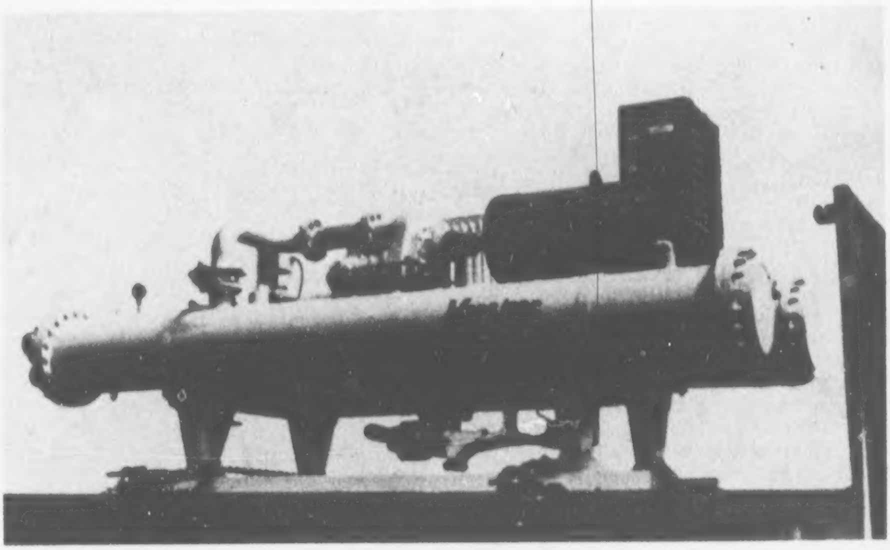
ECONOMICAL POWER GENERATION — Geothermal leaseholders, industries with available waste heat, etc., are potential users of this firm's industrial process heat plant. The firm explains that innovative design features produce a power plant at a lower cost per kW, with more power output, for a given temperature resource. Capable of using low temperature sources cost effectively, this system is said to be ideally suited for recovering excess heat from flue gas, low pressure steam, geothermal brine, solar heated fluids, etc. The price is dependent upon size of system. WRITE: James H. Anderson, Jr., Vice President, J. Hilbert Anderson, Inc., Dept. CN, 2422 South Queen Street, York, Pennsylvania 17402 U.S.A.

ENERGY EFFICIENT/CONSERVATION

FIREPLACE INCORPORATES NEW HEAT CIRCULATION TECHNOLOGY — This "Warm Magic" fireplace uses a new heat circulation technology to produce an energy efficient prefabricated steel fireplace. Heat exchange is provided on all five sides of the firebox, including the top, explains the firm, resulting in over 40 percent heating efficiency when operated with the fan option. Integral features include a standard bifold glass enclosure and outdoor combustion air capability, complete with ductwork and terminations. A concealed control for the adjustable flue damper permits operation when the fireplace is in use. According to the firm, the unique flue throat design makes installation easy even in cases when it is impractical to vent through the ceiling. Distributors, licensees, and sales representatives are actively sought for "Warm Magic" priced from $300 to $450. WRITE: R. A. Hemple, Marketing Manager, The Majestic Company, Dept. CN, 245 Erie Street, Huntington, Indiana 46750 U.S.A. Telex: 232681.

NEW RELAYS TO CONTROL MAIN CIRCUIT CURRENTS — Systems requiring controls or motors can use this firm's new "ABM" relay for switching electricity on and off. These compact 10, 15, and 20 amp normally closed mercury displacement relays feature mercury contacts designed to eliminate wear, welding, and burn-out associated with electro-mechanical devices. The mercury contacts are hermetically sealed in an arc quenching gas atmosphere for quiet, long life operation, explains the firm. They are said to withstand high voltage spikes and are capable of rapid cycling. Prices range from $10 to $25. WRITE: Todd Webster, Int'l. Mktg. Dir., Durakool Incorporated, Dept. CN, 1010 North Main Street, P.O. Box 280, Elkhart, Indiana 46515 U.S.A. Telex: 25-8482.

POWER GENERATION WITHOUT FUEL — The "Organic Rankine Cycle Engine" is able to generate shaft horsepower from waste heat sources, solar heated water, and geothermal water or steam from 66° C and above. Engines may be equipped with electrical generators, air or gas compressors, or pumps from 15 to 1,000 hp. The system uses Freon as a working fluid and incorporates positive displacement expanders said to provide maintenance free operation for many years. Priced from $15,000, this "Organic Rankine Cycle Engine" has many commercial and industrial applications, such as power generation and irrigation pumping. WRITE: Victor Warminger, Dir. of Sales, S.P.S. Inc., Dept. CN, 8801 Biscayne Blvd., P.O. Box 380006, Miami, Florida 33138 U.S.A.



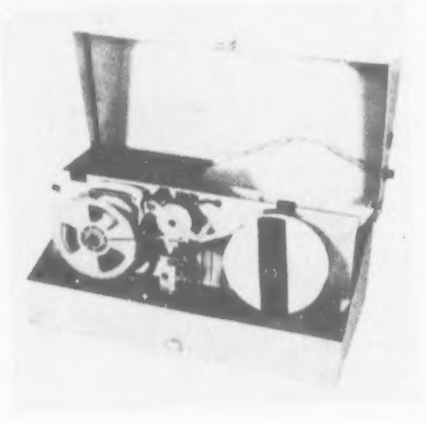
HEAT RECLAIMER PROVIDES FREE HOT WATER — Dairy farms and processing plants can use this "Zero Super Saver" to reclaim heat from a dairy farm bulk milk tank condensing unit to produce hundreds of liters of free hot water. The system uses a 433-1 glass-lined hot water storage tank with urethane foam insulation. Easy to connect, the tank uses no electricity, so utility bills will not be affected. The export price is $1,200. WRITE: O. K. Backhaus, Vice-President, Director of Marketing, Zero Manufacturing Company, Dept. CN, 811 Duncan Avenue, Washington, Missouri 63090 U.S.A. Telex: 44-2476.

NEW FIRE GRATE FOR EFFICIENT WOOD BURNING — This firm's "Texas Fireframe Grate" offers an innovative solution for those hard-to-start and inefficient burning fires. The grate's design features two tall uprights at the front corners, with height-adjustable metal arms that extend into the fireplace. By placing logs on both the upper arms and the base of the "Grate," a slot-shaped cavity is created for easy starting and steady, even-burning fires. The welded, steel construction is designed for heavy-duty use. Shipped knocked-down, the "Grate" is easily assembled in one step. Licensees are sought for the "Grate" priced at $35. WRITE: Lawrence Cranberg, President, Texas Fireframe Company, Dept. CN, P.O. Box 3435, Austin, Texas 78764 U.S.A.

INSTRUMENTATION

WIND DATA ACCUMULATOR — An instrument designed to determine average wind speeds, the "A22 Outdoor Wind Data Accumulator" is useful in determining sites with sufficient wind to justify the installation of a wind turbine generator. Individual homeowners, wind turbine dealers, distributors, and manufacturers, universities, and other institutions are some of the potential end-users of this product. This wind odometer is mounted in weatherproof housing, has a one-year lithium battery power supply, and is said to be particulary ideal for remote applications. According to the firm, the "Wind Data Accumulator" has an ambient temperature range from -40° to 60° C. The instrument sells for $320. Agent and distributor inquiries are welcome. Bank Reference: First National Bank, Boston, Massachusetts. WRITE: Deborra Doscher, Export Marketing Coordinator, Natural Power, Inc., Dept. CN, Francestown Turnpike, New Boston, New Hampshire 03070 U.S.A. Telex: Jastern Jenk 845233.

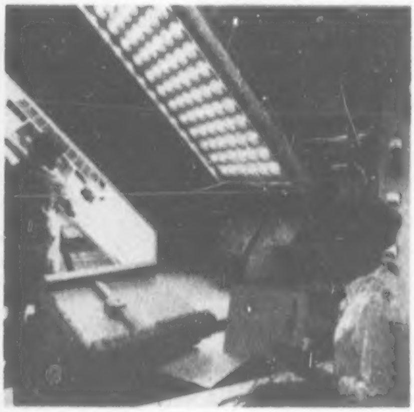
ACCURATE MEASURING UNIT FOR SOLAR RADIATION — This firm's "H-F Self-Calibrating Radiometer" with control unit is a standardization instrument said to permit more accurate and precise solar radiation measurement than previously possible. A unique feature of this double inverted cone instrument, says the firm, is its ability to operate in a wide variety of modes. For use by solar researchers and engineers, the "Radiometer" sells for $6,000. WRITE: George L. Kirk, President, The Eppley Laboratory, Dept. CN, 12 Sheffield Avenue, Newport, Rhode Island 02840 U.S.A. Telex 955-329. Cable: EPLAB.



ENERGY MONITOR — The "Stevens Energy Monitor" can be used by installers of wind energy systems or solar heating and cooling systems to determine the respective wind velocity or amount of solar heat received by the collector. Volume and time of pulse output is recorded in a unique print-punch tape format that can be visually read and machine processed for printed reports. Enclosed in a weatherproof case, the "Energy Monitor" is portable and battery operated with a versatile control panel for easy programming, according to the firm. The export price range is from $1,800 to $2,000. WRITE: Ralph S. Blois, Marketing Services Manager, Leupold and Stevens, Inc., Dept. CN, P.O. Box 688, Beaverton, Oregon 97075 U.S.A. Telex: 15-1227. Cable: LEUSTEV.

EDUCATIONAL AND RESEARCH AIDS

SOLAR ENERGY SOFTWARE PROGRAMS — Designed primarily for engineers, architects, scientific institutions, and companies working in the solar energy field, the "Solarcon Software Programs" are prerecorded magnetic cards which can be used with the programmable calculators TI59 from Texas Instruments and HP 41C from Hewlett-Packard. Detailed descriptions, instructions, and sample calculations assist the user to calculate solar insolation values, collector efficiency curves, and complete solar energy systems. Weather data cards permit annual performance estimates of active and passive solar energy heating systems. Prices for the programs range from $100 to $1,000. WRITE: Norlene Martin, Solarcon, Inc., Dept. CN, 607 Church, Ann Arbor, Michigan 48104 U.S.A.



SIMULATED SOLAR CONDITIONS FOR TESTING PRODUCTS — This firm's "Solar Simulator" has been designed for use by manufacturers, universities, and government facilities to evaluate solar thermal and photovoltaic conversion devices. The controlled indoor environment, explains the firm, includes ambient temperature control from 15° to 43° C, wind speeds from 9 to 4.5 m/s and radiant energy control from 250 to 1,000 W/m^2. The facility consists of a power condition rated at 30 kW, a 120 by 240 cm lamp array with supporting optics, a 120 by 240 cm test platform, and a high speed data acquisition system. The export price range is from $50,000 to $100,000. WRITE: Ralph Barber, Director, Solar Energy Systems Division, Wyle Laboratories, Dept. CN, 7800 Governors Drive West, Huntsville, Alabama 35807 U.S.A.

U.S. GOVERNMENT SPONSORED EVENTS OVERSEAS

COMMERCE SPONSORED EVENTS

This list presents trade catalog exhibitions, seminars, fairs, and trade missions sponsored overseas by the U.S. Department of Commerce in 1981 and 1982. Additional information on these events can be obtained from the contact individual or office sponsoring the event. If overseas, contact the nearest U.S. Embassy. The listed events/dates are subject to change or cancellation without prior notice.

CATALOG EXHIBITIONS

U.S. ENERGY SYSTEMS
May 26 - June 5, 1981
Japan and Korea

CONVENTIONAL AND NON-CONVENTIONAL ENERGY SYSTEMS AND EQUIPMENT
September 1981
India

For information on the above catalog exhibitions, contact: Catalog Exhibitions, Room 6051, Office of Export Promotion, U.S. Department of Commerce, Washington, D.C. 20230 U.S.A.

SEMINAR MISSIONS

ENERGY SYSTEMS
September 1981
Colombia, Peru, and Venezuela

SOLAR AND ALTERNATE ENERGY SOURCES
August 1982
Indonesia, Philippines, Taiwan, and Thailand

For information on the above seminar missions, contact: Richard Nevers, Office of Export Promotion, Room 6051, U.S. Department of Commerce, Washington, D.C. 20230 U.S.A.

TRADE FAIR

ALTERNATE ENERGY SOURCES
January 1982
U.S. Export Development Office
Tokyo, Japan

For information on the above trade fair, contact: James Meid, Office of Export Promotion, Room 4021, U.S. Department of Commerce, Washington, D.C. 20230 U.S.A.

SOLAR ENERGY/HEAT EXCHANGE
"EUROCLIMA" (Market Launch)
February 1982
Belgium

ENERGY CONSERVATION
(Trade Mission)
February 1982
Hong Kong and Korea

For information on the above events, contact: James Meid, Office of Export Promotion, Room 4021, U.S. Department of Commerce, Washington, D.C. 20230 U.S.A.

TERMS USED IN THIS LISTING:

Export Development Office — Permanent facilities which the U.S. Department of Commerce maintains abroad.

Specialized Trade Missions and Seminar Missions — Groups of U.S. business representatives who travel as official U.S. Government sponsored missions to facilitate the sales of U.S. technology and products overseas.

Business Sponsored Promotions — Between regularly scheduled Commerce sponsored shows, individual firms (or their overseas agents), use the EDO's with exhibition facilities for individual product promotions, sales, seminars, and conferences.

Catalog Exhibitions — Usually held in U.S. Embassies abroad or with an exhibition, these feature displays of numerous U.S. product catalogs, sales brochures, and other graphic sales aids.

Trade Fairs — International exhibitions usually targeted to a particular industry.

Solo Fairs — Exhibition of U.S. products targeted to a particular industry in which only U.S. firms and their agents may participate.

Market Launch Service — Commerce program that facilitates participation of U.S. firms in selected European trade fairs.

JOINTLY SPONSORED EVENTS

The U.S. Department of Commerce, Office of Export Marketing Assistance (OEMA), in association with the U.S. Department of Energy, International Market Development Program (IMD), is sponsoring a series of overseas solar and conservation events in 1981. Dates and locations of events should be confirmed by contacting William R. Burris, HRM Inc., 1101 30th Street, NW., Suite 301, Washington, D.C. 20007 U.S.A.

May 13 - June 3, 1981	FAR EAST ENERGY EVENT Jakarta, Manila, Tokyo, Seoul
September 11 - 30, 1981	SOUTH AMERICAN ENERGY EVENT Buenos Aires, Sao Paulo
September 11 - 20, 1981	ENERGY EVENT Zagreb

NON-GOVERNMENT SPONSORED EVENTS OVERSEAS

The following are overseas seminars, trade shows, and conferences on energy sponsored by various organizations. For further information, contact the individuals or organizations listed with each event.

April 29-May 1
1981

INTERNATIONAL CONFERENCE ON ENERGY STORAGE
Bedford Hotel, Brighton, England
Contact:
BHRA Fluid Engineering
Energy Storage
Cranfield, Beds, MK43 0AJ, England
Sponsor: BHRA Fluid Company; Energy Technology Support Unit; Science Research Council
Comments: Topics include low grade heat storage (phase change, rock bed, bulk liquid store, etc.), industrial heat storage, pumped storage/tidal, underground compressed air/gas, electrical/chemical batteries, aquifer storage, flywheels.

May 2-10, 1981

INTERNATIONAL TRADE FAIR OF VALENCIA
Valencia, Spain
Contact:
Feria Internacional de Valencia
Apartado 476
Valencia, Spain

May 9-14, 1981

ASHRAE-CIBS LONDON CONFERENCE 1981
Piccadilly Hotel, London, England
Contact:
C. T. Zegers
ASHRAE
United Engineering Center
345 East 47th Street
New York, New York 10017 U.S.A.
Sponsor: American Society of Heating, Refrigerating and Air-Conditioning Engineers; Chartered Institute of Building Services
Comments: Energy utilization in buildings and building engineering services in Europe and the U.S. Includes discussion on alternative energy sources, environment control and conservation.

May 19-22, 1981
ENERGY 81
Essen, Federal Republic of Germany
Contact:
Mack-Brooks Exhibitions Limited
62 Victoria Street, St. Albans
Herts. AL1 3XT, England
Sponsor: Mack-Brooks Exhibitions Limited; Austellungs und Messegesellschaft mbH Essen

June 1-5
VKI LECTURE SERIES ON WIND ENERGY DEVICES
Rhode-St. Genese, Belguim
Contact:
Von Karman Institute for Fluid Dynamics
Chaussee de Waterloo 72
B-1640
Rhode-St. Genese, Belgium
Sponsor: Von Karman Institute for Fluid Dynamics

August 10-21, 1981
UN CONFERENCE ON NEW AND RENEWABLE SOURCES OF ENERGY
Nairobi, Kenya
Contact:
Information Officer
United Nations Conference on New and Renewable Sources of Energy
DESI/DPI-Room 1072-C
United Nations
New York, New York 10017 U.S.A.
Sponsor: United Nations

August 23-29, 1981
INTERNATIONAL SOLAR ENERGY SOCIETY CONGRESS AND EXHIBITION
Congress Centre, Brighton, England
Contact:
June Morton
UK-ISES
19 Albemarle Street
London W1K 3HA, England
Sponsor: International Solar Energy Society/United Kingdom Section
Comments: Covers various solar fields with emphasis on technological training support for developing countries. Held with large exhibition on renewable energy and energy conservation.

September 8-12, 1981
INELTEC 81
Basel, Switzerland
Contact:
Sekretariat INELTEC
Swiss Industries Fair Basel
CH-4021 Basel, Switzerland

September 11-15
1981

5TH INTERNATIONAL THIN FILMS CONGRESS - THIN FILMS: PROPERTIES AND DEVICES
Sharon Hotel, Herzlia-on-Sea, Tel-Aviv, Israel
Contact:
Y. Shapira
Congress Secretary
Tel-Aviv University
School of Engineering
Raniat Aviv, Tel-Aviv, Israel
Sponsor: The International Union of Vacuum Science, Technique and Applications; The International Thin Films Committee; The Israeli Physical Society; Tel-Aviv University; Technion-Israel Institute of Technology
Comments: The deadline for submission of abstracts is April 15, 1981. Topics include nucleation and growth of thin films, interfaces, characterization and applications, mechanical properties of thin films, electrical transport, photo-electric and magnetic properties and more.

October 4-9, 1981

2ND WORLD CONGRESS OF CHEMICAL ENGINEERING
Montreal, Quebec, Canada
Contact:
Musa R. Kamal
Program Chairman
McGill University
3480 University St.
Montreal, Quebec, Canada
Sponsor: Canadian Society for Chemical Engineering; American Institute of Chemical Engineers
Comments: Several energy-related sessions are scheduled, including solar energy and thermal energy storage.

October 26-30, 1981

ICEUM III: 3RD INTERNATIONAL CONFERENCE ON ENERGY USE MANAGEMENT
Berlin, West Germany
Contact:
Marcia Untracht
ICEUM III
P.O. Box 64369
Los Angeles, California 90064 U.S.A.
Sponsor: Interdisciplinary Group for Ecology, Development and Energy; Department of Energy, Commission of the European Communities, Brussels; Senate of Berlin; Organization for Economic Co-Operation and Development
Comments: Theme: Beyond the Energy Crisis: Opportunity and Challenge. ICEUM III is intended for individuals from all areas of the world, involved in various disciplines. Participation of individuals from developing countries is a high priority.

TRADE EVENTS IN THE U.S.

For additional information on the following selected energy conferences and seminars scheduled in the United States during 1981 and 1982, please contact the individual or organization listed.

May 5-6, 1981

PHOTOVOLTAICS
University of Wisconsin - Extension, Madison, Wisconsin
Contact:
Charles Fafard
University of Wisconsin - Extension
Department of Engineering and Applied Science
432 North Lake Street
Madison, Wisconsin 53706 U.S.A.
Sponsor: University of Wisconsin - Extension

May 10-14, 1981

ASTM COMMITTEE E-44: SOLAR ENERGY CONVERSION
Town and Country Hotel, San Diego, California
Contact:
Janet Schroeder
American Society of Testing and Materials
1916 Race Street
Philadelphia, Pennsylvania 19103 U.S.A.
Sponsor: American Society of Testing and Materials

May 10-15, 1981

ELECTROCHEMICAL SOCIETY SPRING MEETING 1981
Leamington Hotel, Minneapolis, Minnesota
Contact:
The Electrochemical Society, Inc.
P.O. Box 2071
Princeton, New Jersey 08540 U.S.A.
Sponsor: Electrochemical Society

May 11-12, 1981

ADVANCED PASSIVE SOLAR DESIGN
University of Wisconsin - Extension, Madison, Wisconsin
Contact:
Donald Schramm
University of Wisconsin - Extension
Department of Engineering and Applied Science
432 North Lake Street
Madison, Wisconsin 53706 U.S.A.
Sponsor: University of Wisconsin - Extension

May 11-15, 1981	15th PHOTOVOLTAIC SPECIALISTS CONFERENCE Orlando Hyatt, Orlando, Florida Contact: Charles J. Bishop Solar Energy Research Institute 1617 Cole Boulevard Golden, Colorado 80401 U.S.A. Sponsor: Institute of Electrical and Electronic Engineers Comments: Intended for specialists in all aspects of photovoltaic technology (systems) applications.
May 12-14, 1981	COMMERCIAL HYDRONIC HEATING SCHOOL Holiday Inn-North, Denver, Colorado Contact: IBR Schools 35 Russo Place P.O. Box 262 Berkeley Heights, New Jersey 07922 U.S.A. Sponsor: The Hydronics Institute Comments: Fee: $95. Subjects include: design water temperature, greater temperature drops, selecting the type of hydronic system for buildings and design tables.
May 18-22, 1981	A/C DESIGN - COMPUTER-AIDED ANALYSIS University of Wisconsin, Madison, Wisconsin Contact: Charles E. Dorgan University of Wisconsin - Extension Department of Engineering and Applied Science 432 North Lake Street Madison, Wisconsin 53706 U.S.A. Sponsor: University of Wisconsin - Extension Comments: Energy analysis section includes solar.
May 19-21, 1981	RESIDENTIAL HEAT LOSS AND PIPING DESIGN SCHOOL Holiday Inn - Expressway, Kalamazoo, Michigan Contact: IBR Schools 35 Russo Place P.O. Box 262 Berkeley Heights, New Jersey 07922 U.S.A. Sponsor: The Hydronics Institute Comments: Fee: $85. Subjects include: calculation of heat loss, system design, piping arrangements, control arrangements for heat and hot water, and selling energy conservation with hydronics.

May 26-28, 1981

RESIDENTIAL HEAT LOSS AND PIPING DESIGN SCHOOL
Holiday Inn - International Airport, Cheektowaga, New York
Contact:
IBR Schools
35 Russo Place
P.O. Box 262
Berkeley Heights, New Jersey 07922 U.S.A.
Sponsor: The Hydronics Institute
Comments: Fee: $85. Subjects include: calculation of heat loss, system design, piping arrangements, control arrangements for heat and hot water, and selling energy conservation with hydronics.

May 26-30, 1981

SOLAR RISING
Philadelphia Civic Center, Philadelphia, Pennsylvania
Contact:
Rick Ross
University of Pennsylvania
Research Institute for Advanced Technology
Room B-2 Bennett Hall
Philadelphia, Pennsylvania 19104 U.S.A.
Comments: Major emphasis on solar in cities, both active and passive.

June 3-5, 1981

1981 WOOD ENERGY TRADE SHOW AND CONFERENCE
Seattle Center, Seattle, Washington
Contact:
Mary Crandal
Manager
Wood Energy Trade Show and Conference
Puyallup, Washington 98371 U.S.A.
Sponsor: Wood Energy Institute.West; Washington State
Comments: The 1981 Public Wood Energy Show will be held June 6 and 7.

June 9-11, 1981

RESIDENTIAL HEAT LOSS AND PIPING DESIGN SCHOOL
Holiday Inn, Parsippany, New Jersey
Contact:
IBR Schools
35 Russo Place
P.O. Box 262
Berkeley Heights, New Jersey 97922 U.S.A.
Sponsor: The Hydronics Institute
Comments: Fee: $85. Subjects include: calculation of heat loss, system design, piping arrangement, control arrangements for heat and hot water, and selling energy conservation with hydronics.

June 14-17, 1981

ASME SUMMER ANNUAL MEETING
MGM Grand Hotel, Reno, Nevada
Contact:
Eileen Lanman
American Society of Mechanical Engineers
345 East 47th Street
New York, New York 10017 U.S.A.
Sponsor: American Society of Mechanical Engineers

June 16-18, 1981

COMMERCIAL HYDRONIC HEATING SCHOOL
Holiday Inn, Framingham, Massachusetts 01701
Contact:
IBR Schools
35 Russo Place
P.O. Box 262
Berkeley Heights, New Jersey 07922 U.S.A.
Sponsor: The Hydronics Institute
Comments: Fee: $95. Subjects include: design water temperature, greater temperature drops, selecting the type of hydronic system for buildings and design tables.

June 18-19, 1981

SCIENCE POLICY COLLOQUIUM
Washington, D.C.
Contact:
Joan Wrather
AAAS Meetings Office
1776 Massachusetts Avenue NW.
Washington, D.C. 20036 U.S.A.
Sponsor: American Association for the Advancement of Science

June 19-23, 1981

NATIONAL ASSOCIATION OF PLUMBING - HEATING - COOLING CONTRACTORS CONVENTION/ EXPOSITION
Anaheim, California
Contact:
Joe Childers
NAPHCC
1016 20th Street NW.
Washington, D.C. 20036 U.S.A.
Sponsor: National Association of Plumbing - Heating - Cooling Contractors

June 20-25, 1981

FOREST PRODUCTS RESEARCH SOCIETY 35th ANNUAL MEETING
Radisson St. Paul, St. Paul, Minnesota
Contact:
Connie Walling
Forest Products Research Society
2801 Marshall Court
Madison, Wisconsin 53705 U.S.A.
Sponsor: Forest Products Research Society

June 23-25, 1981

COMMERCIAL HYDRONIC HEATING SCHOOL
The Cellar, Holiday Inn, Rockville Center, New York
Contact:
IBR Schools
35 Russo Place
P. O. Box 262
Berkeley Heights, New Jersey 07922 U.S.A.
Sponsor: The Hydronics Institute
Comments: Fee: $95. Subjects include: design water temperature, greater temperature drops, selecting the type of hydronic system for commercial buildings, and design tables.

June 28-July 2, 1981

ASHRAE ANNUAL MEETING
Netherlands Hilton, Cincinnati, Ohio
Contact:
Ralph S. Burkowsky
ASHRAE
345 East 47th Street
New York, New York 10017 U.S.A.
Sponsor: American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

August 3-5, 1981

ENERGY IN THE MAN-BUILT ENVIRONMENT - THE NEXT DECADE
Vail, Colorado
Contact:
Richard L. Anglin
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, California 91103 U.S.A.

September 7-12, 1981

6th NATIONAL PASSIVE SOLAR CONFERENCE
Portland, Oregon
Contact:
Mary Lawrence
Western Sun
715 SW. Morrison
Portland, Oregon 97205 U.S.A.
Sponsor: American Section/International Solar Energy Society
Comments: Topics covered include marketing, financing, and appraisal, site development for solar passive, solar construction technology, passive solar remodeling.

October 2-4, 1981

ENERGY EXPO 1981
Currigan Hall, Denver, Colorado
Contact:
Mary Jo Doherty
Energy Exposition
204 West Linnwood
Kansas City, Missouri 64111 U.S.A.
Sponsor: Energy Exposition
Comments: Fee: $2.50, students $1.50. Exhibits designed to present the latest happenings in the energy world emphasizing energy conservation and alternative energy sources.

October 4-7, 1981

WIND WORKSHOP V
Washington, D.C.
Contact:
Solar Energy Research Institute
Conferences Group
1617 Cole Boulevard
Golden, Colorado 80401 U.S.A.
Sponsor: Solar Energy Research Institute

October 4-7, 1981

JOINT POWER GENERATION CONFERENCE
Sheraton St. Louis, St. Louis, Missouri
Contact:
Cathy Mortise
American Society of Mechanical Engineers
345 East 47th Street
New York, New York 10017 U.S.A.
Sponsor: Institute of Electrical and Electronics Engineers; American Society of Mechanical Engineers; American Society of Civil Engineers

October 16-18, 1981

ENERGY EXPO 1981
Mecca Convention Center, Milwaukee, Wisconsin
Contact:
Mary Jo Doherty
Energy Exposition
204 West Linnwood
Kansas City, Missouri 64111 U.S.A.
Sponsor: Energy Exposition
Comments: Fee: $2.50, students $1.50. Exhibits designed to present the latest happenings in the energy world emphasizing energy conservation and alternative energy sources.

October 21-23, 1981
INTERNATIONAL ELECTRIC VEHICLE COUNCIL SYMPOSIUM
Baltimore, Maryland
Contact:
Lynn Andrews
Electric Vehicle Council
1111 19th Street NW., Suite 606
Washington, D.C. 20036 U.S.A.
Sponsor: Electric Vehicle Council

October 25-29, 1981
GEOTHERMAL: THE INTERNATIONAL SUCCESS STORY
Houston, Texas
Contact:
Beverly A. Hall
Geothermal Resource Council
P.O. Box 98
Davis, California 95617 U.S.A.
Sponsor: Geothermal Resources Council

November 1-4, 1981
SOLAR ENERGY INDUSTRIES ASSOCIATION ANNUAL MEETING/TRADE SHOW AND EXHIBITION
Las Vegas, Nevada
Contact:
Solar Energy Industries Association
1001 Connecticut Avenue, NW.
Washington, D.C. 20036 U.S.A.

December 14-16, 1981
4th MIAMI INTERNATIONAL CONFERENCE ON ALTERNATIVE ENERGY SOURCES
Miami Beach, Florida
Contact:
Dr. T. Nejat Veziroglu, Director
University of Miami
Clean Energy Research Institute
P.O. Box 248294
Coral Gables, Florida 33124 U.S.A.
Sponsor: Clean Energy Research Institute, University of Miami; International Association for Hydrogen Energy.
Comments: Will present latest information on status and future possibilities of renewable energies. Social and environmental effects will be addressed.

January 24-27, 1982
ASHRAE SEMIANNUAL MEETING
Shamrock Hilton, Houston, Texas
Contact:
Ralph Burkowsky
ASHRAE
345 East 47th Street
New York, New York 10017 U.S.A.
Sponsor: American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

February 17-19, 1982 EGSMA CONVENTION
Orlando Hyatt House, Orlando, Florida
Contact:
Hattie Banbury
Electrical Generating Systems Marketing Association
435 North Michigan Avenue, Suite 1717
Chicago, Illinois 60611 U.S.A.
Sponsor: Electrical Generating Systems Marketing Association

March 7-11, 1982 ENERGY TECHNOLOGY CONFERENCE AND EXHIBITION
Rivergate Hilton, New Orleans, Louisiana
Contact:
Peter Fromme
American Society of Mechanical Engineers
Technical Affairs Department
345 East 47th Street
United Engineering Center
New York, New York 10017 U.S.A.
Sponsor: American Society of Mechanical Engineers

March 28-April 2, 1982 183rd ACS NATIONAL MEETING
Las Vegas, Nevada
Contact:
A.T. Winstead
American Chemical Society
1155 16th Street NW.
Washington, D.C. 20036 U.S.A.
Sponsor: American Chemical Society
Comments: Includes session on plastics for solar energy.

May 1-October 31, 1982 THE 1982 WORLD'S FAIR
Downtown Knoxville, Tennessee
Contact:
S. H. Roberts, Jr.
Energy Expo 82
P.O. Box 1982
Knoxville, Tennessee 37901 U.S.A.
Comments: Proposed solar tower, biomass converter, and solar collector on U.S. pavilion.

May 7-8, 1982 ALTERNATE FUELS FOR INDUSTRIAL USE
Hotel Washington, Washington, D.C.
Contact:
Martin Heavner
Government Institutes, Inc.
P.O. Box 1069
Rockville, Maryland 20850 U.S.A.
Sponsor: Government Institutes, Inc.

May 23-27, 1982
WORLD ENERGY CONGRESS - WORLD'S FAIR ENERGY EXPO
Knoxville, Tennessee
Contact:
Walter Lambert
1982 World's Fair
P.O. Box 1982
Knoxville, Tennessee 27901 U.S.A.
Sponsor: 1982 World's Fair

TRADE ASSOCIATIONS

This list presents trade associations of U.S. manufacturers involved in the production of energy equipment.

American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE)
345 East 37th Street
New York, New York 10017 U.S.A.

American Wind Energy Association (AWEA)
1609 Connecticut Avenue, NW.
Washington, D.C. 20009 U.S.A.

Bio-Energy Council
1625 Eye Street, NW.
Suite 825-A
Washington, D.C. 20006 U.S.A.

Solar Energy Industries Association
1001 Connecticut Avenue, NW.
Washington, D.C. 20036 U.S.A.

American Solar Energy Association
928 Barr Building
Washington, D.C. 20006 U.S.A.

Association of Energy Engineers, Inc.
464 Armour Circle NE.
Atlanta, Georgia 30324 U.S.A.

American Section/International Solar Energy Society
American Technological University
P.O. Box 1416
Killeen, Texas 76541 U.S.A.

LICENSING AND INVESTMENT PROPOSALS

POWER GENERATION FROM UNDERGROUND ROCKS — This firm offers to license a patented process to generate electric power using heat extracted from hot, dry rocks deep underground by means of a closed fresh water loop. The system is designed to extract 356 million Btu/h per earth loop. The patented process will be applied to create a very large rock-to-fluid heat exchanger. WRITE: Mr. J.W. Foster, Senior Vice President, HDR Energy Development Corporation, Dept. CN, 1500 Southern Finance Building, Augusta, Georgia 30902 U.S.A.

TRADE AND TECHNICAL LITERATURE

MONTHLY PUBLICATION ON OCEAN ENERGY — "Solar Ocean Energy Liaison" is recommended by its publisher as the only source of current and accurate worldwide information on all forms of solar energy from the sea, including Ocean Thermal Energy Conversion (OTEC), wave, tidal, current, offshore wind, biomass and salinity gradients, and solar ponds. Regular features include domestic and international political forecasts and reports, U.S. Congressional activities, corporate and government plans, U.S. Government Procurement invitations and contract awards, and research and test data. The monthly publication costs $125 for a 1-year subscription and $200 for a 2-year subscription. Please add $15 per year for air mail postage. Sample copies and literature will be sent at no charge upon request. WRITE: Richard A. Meyer, Editor and Publisher, Solar Ocean Energy Liaison, Popular Products, Inc., Dept. CN, 1303 South Michigan Avenue, Chicago, Illinois 60605 U.S.A.

NEWSLETTER ON SOLAR ENERGY — "Solar Energy Intelligence Report" is recommended by its publisher as the most informative weekly newsletter on solar energy activities. It provides useful news on solar heating and cooling, process heating, photovoltaics, wind energy, ocean energy, solar thermal electricity, biomass, and alcohol fuels. Developments in U.S. business and government and around the world are covered, including technological advances, commercial and marketing news, policy decisions, patent abstracts, related publications, contract tips, and a calendar of upcoming events. The subscription rate is $162 a year. WRITE: Allan L. Frank, Editor, Business Publishers, Inc., Dept. CN, Box 1067 Blair Station, Silver Spring, Maryland 20910 U.S.A.

REPORTS ON BIOMASS TECHNOLOGY — According to the publisher, the monthly "Biomass Digest" is the only publication devoted exclusively to new technological developments involving the use of biomass as a raw material for the production of chemicals or for energy conversion. Said to be a high level technical publication, each issue contains information on meetings, new patents, reports, and technical papers. The foreign subscription rate, including air mail, is $132 for 12 issues. The publisher has also released a report on 40 existing chemical processes based on biomass raw materials. The "Biomass Process Handbook" is designed to provide data needed to evaluate existing biomass alternatives to petrochemicals. Each of these processes discussed contains information on marketing, economics, flow sheet, equipment, plant investment costs, and detailed operating costs. The price is $470. WRITE: Kenneth A. Kovaly, Publisher, Technical Insights, Inc., Dept. CN, P.O. Box 1304, 158 Linwood Plaza, Fort Lee, New Jersey 07024 U.S.A.

TECHNICAL MANUAL AND HISTORY OF SOLID FUEL GASIFICATION — "The Pegasus Unit" is recommended by the publisher as a most comprehensive manual and history on the European method of solid fuel gasification that was developed to meet petroleum shortages during World War II. These air-gas generators used wood and the existing reciprocating engines. In 11 chapters, with 52 plates and figures, the book presents all the necessary design and operation data so that users can rediscover the lost science of driving without gasoline. The cost, including postage, is $12.95 prepaid. WRITE: Mark L. Papworth, Pegasus Publishers, Inc., Dept CN, P.O. Box 121, Olympia, Washington 98507 U.S.A.

GUIDE TO ALL U.S. MANUFACTURED SOLAR PRODUCTS AND SYSTEMS —The "Solar Products Specifications Guide" is a 2-volume book that gives complete descriptions and technical specifications on over 800 solar products and complete systems. Arranged in 39 categories, these products cover computer applications, glazings, collectors and components, controls, instrumentation, passive products, air and water heating systems, photovoltaics, storage containers, and more. On a renewable basis, subscribers receive bimonthly update packages consisting of over 100 pages of new and revised technical data, which can be inserted into the 3-ring looseleaf binders. The subscription rate for the books shipped by surface mail and the updates by air is $190. For books shipped air collect and updates by air, the cost is $185. The approximate weight of the two volumes is 6.3 kg. The yearly update service renewal cost is $115. WRITE: Ron Subka, Project Director, Solar Age Magazine, Dept. CN, Church Hill, Harrisville, New Hampshire 03450 U.S.A.

TECHNICAL MAGAZINE ON THE SOLAR INDUSTRY — A monthly publication covering all technical aspects and developments in the solar energy field, "Solar Engineering Magazine" is recommended to anyone interested in monitoring the growth of the industry in the United States. In each issue, articles highlight different solar applications, including residential, commercial, and industrial, and research and development activities. Descriptions and photographs of new solar products introduced to the market are also included. Other features cover government actions inpacting solar, reviews of solar literature, industry news, and special solar product directories. Subscription rates are $29 for one year, $47 for two years, and $65 for three years. WRITE: Michael Holland, Publisher, Solar Engineering Publishers, Inc., Dept. CN, 2636 Walnut Hill Lane, Suite 257, Dallas, Texas 75229 U.S.A.

MONTHLY MAGAZINE ON SOLAR ENERGY — The official magazine of the American Section of the International Solar Energy Society, "Solar Age" provides practical information for energy conscious people. "Solar Age" is recommended by its publisher as a thorough, informative, and up-to-date medium on the U.S. solar industry. Each issue offers feature articles on products, designs, business highlights, solar economics, etc. New product updates, patents, and a listing of upcoming events are also included. The subscription rate for 12 issues, air mail delivery, is $32. WRITE: Deborah Napior, General Manager, SolarVision, Inc., Dept. CN, Church Hill, Harrisville, New Hampshire 03450 U.S.A.

PRACTICAL GUIDE ON SOLAR HEATING AND COOLING — "Solar Heating and Cooling of Residential Buildings," prepared by the Department of Commerce's Economic Development Administration, deals with selection costs, testing, operation, and maintenance of liquid and air heating solar systems for hot water and space heating in locations throughout the United States. Available in two illustrated volumes, the manual also examines solar cooling methods and systems operations. Potential end-users include builders, contractors, homeowners, architects, and engineers. Please specify stock number and title when ordering. "Design of Systems", S/N 003-011-00089-5, is $12 per copy. "Sizing, Installation and Operation of Systems", S/N 003-001100088-7 is $10 per copy. WRITE: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 U.S.A.

ADDITIONAL LISTING OF JOURNALS

This is a selected list of additional journals which focus on renewable energy technologies. Further information on the content, subscription rates, and availability should be obtained by writing to the publisher.

Advanced Solar Energy Technology
1609 West Windrose
Phoenix, Arizona 85029 U.S.A.

Energy Research Digest
P.O. Box 17162
Washington, D.C. 20041 U.S.A.

Energy Today
Trends Publishing Company
National Press Building
Washington, D.C. 20045 U.S.A.

Solar Energy
Pergamon Press, Inc.
Maxwell House
Fairview Park
Elmsford, New York 10523 U.S.A.

Solar Heating and Cooling
Gordon Publications Inc.
20 Community Place
Morristown, New Jersey 07960 U.S.A.

Synerjy
P.O. Box 4790
Grand Central Station
New York, New York 10017 U.S.A.

Tranet
P.O. Box 587
Rangeley, Maine 04970 U.S.A.

Wind Energy Report
Wind Publishing Company
P.O. Box 14
Rockville Centre, New York 11571 U.S.A.

Windletter
American Wind Energy Association
1621 Connecticut Aveneue N W.
Washington, D.C. 20009 U.S.A.

Wind Power Digest
American Wind Energy Association
1621 Connecticut Avenue, N W.
Washington, D.C. 20009 U.S.A

Wind Technology Journal
P.O. Box 7
Marston Mills, Massachusetts 02648 U.S.A.

Wood 'n' Energy
5 South State Street
Concord, New Hampshire 03301 U.S.A.

SELECTED U.S. GOVERNMENT PUBLICATIONS ON RENEWABLE ENERGY TECHNOLOGIES

Numerous departments within the U.S. government have published documents addressing various aspects of renewable energy technologies. The following list presents selected publications and is not intended to be inclusive. Prices are given where known. For foreign orders of GPO publications, please add 25 percent to the price. For those publications without a source or for additional information on other publications in this area, please write to the U.S. Department of Energy, Washington, D.C. 20585 U.S.A. The complete addresses of the sources noted in the list are as follows:

National Technical Information
Service (NTIS)
5285 Port Royal Road
Springfield, Virginia 22161 U.S.A.

Superintendent of Documents
U.S. Government Printing Office (GPO)
Washington, D.C. 20402 U.S.A.

Solar Energy Research
Institute (SERI
1617 Cole Boulevard
Golden, Colorado 80401 U.S.A.

ACTIVE SOLAR HEATING AND COOLING

A Comparision of Six Generic Solar Domestic Hot Water Systems, Solar Energy Research Institute, SERI/ RR-351-413, March 1980, 62 pages, from SERI.

Hot Water From the Sun: A Consumer Guide to Solar Water Heating, U.S. Department of Housing and Urban Development,HUD-PDR-548, May 1980, 123 pages, from GPO.

Installation Guidelines for Solar DHW Systems in One- and Two-Family Dwellings, U.S. Department of Housing and Urban Development, HUD-PDR-407 (2), May 1980, 107 pages, from GPO.

Proceedings of the Annual DOE Active Solar Heating and Cooling Contractors' Review Meeting, U.S. Department of Energy, March 26-28, 1980, CONF 800340, UC-59c, from NTIS, $21.00 for printed copy, $3.50 for microfiche.

The Role of Education and Training Programs In The Commercialization and Diffusion of Solar Energy Technologies, Solar Energy Research Institute, SERI/RR-53-128, January 1979, 56 pages, from SERI.

NATO Committee on the Challenges of Modern Society Solar Energy Pilot Study: Final Report, U.S. Department of Energy, CCMS No. 83/UMD-4908-13, October 1978, 94 pages.

Simulations and Economic Analysis of Desiccant Cooling Systems, Solar Energy Research Institute, SERI/TR-34-090. June 1979, 197 pages, from SERI.

BIOMASS ENERGY SYSTEMS

Assessment of Industrial Activity in the Utilization of Biomass for Energy, U.S. Department of Energy, DOE/ PE/70090-01, Sept. 1980, 43 pages, from NTIS, $13.00 for printed copy, $4.00 for microfiche.

Commercialization of Wood Combustion Systems, Technical Inputs to Phase II: Readiness Assessment, U.S. Department of Energy, MTR-79WOO278, August 1979.

Energy from Biological Processes, July 1980; Summary, OTA-E-123, 23 pages, free from Office of Technology, Assessment, U.S. Congress, OTA Publishing Office, Washington, D.C. 20510 U.S.A.; vol.1, OTA-E-124 195 pages, from GPO, 052-003-00762-2, $6.00; vol. II, Technical and Environmental Analysis, OTA-E-128, 234 pages, from GPO, 052-003-00782-7, $6.50.

A Guide to Commercial-Scale Ethanol Production and Financing, Solar Energy Research Institute, SERI/SP- 751-877, UC-61, Nov. 1980, 124+ pages, from GPO, 061-000-00472.

Heating with Wood, U.S. Department of Energy, DOE/CS-0158, May 1980, 20 pages.

Small-Scale Fuel Alchol Production, U.S. Department of Agriculture, March 1980.

A Survey of Biomass Gasification Volume 1; Synopsis and Executive Summary, Solar Energy Research Institute, SERI/TR-33-239(vol. 1.), July 1979, 250 pages, from SERI.

The Costs of Using Crop Residues in Direct Combustion Applications, Solar Energy Research Institute, SERI/TR-353-513, March 1980, 43 pages, from SERI

Fuel from Farms - A Guide to Small Scale Ethanol Production, Solar Energy Research Institute, SERI/SP-451-519, UC-61, February 1980, 89+ pages, from GPO,.$4.50

SMALL HYDROPOWER

Feasibility Studies for Small-Scale Hydropower Additions: A Guide Manual, U.S. Army Corps of Engineers, July 1979, from the Hydrologic Engineering Center, 609 2nd Street, Davis, California 95616 U.S.A. $14.00.

Fundamental Economic Issues in the Development of Small Scale Hydro, U.S. Department of Energy, DOE/RA/04934- 02, UC-97e, May 1980, 26 pages, from NTIS, $6.00 for printed copy, $4.00 for microfiche.

Micro-Hydro Power: Reviewing an Old Concept, U.S. Department of Energy, DOE/ ET/01752-1, UC-97e, January 1979, 60 pages.

Waterpower '79: The First International Conference on Small-Scale Hydropower, Abstracts, Oct. 1-3, 1979, U.S. Army Corps of Engineers and U.S. Department of Energy, from GPO.

OCEAN ENERGY SYSTEMS

Ocean Energy Systems, Program Summary, Fiscal Year 1979, U.S. Department of Energy, DOE/ET-0118, UC-64, from NTIS, $11.00 for printed copy, $3.00 for microfiche.

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National Solar Heating and Cooling Information
Center (NSHCIC)
P.O. Box 1607
Rockville, Maryland 20850 U.S.A.

National Alcohol Fuels Information Center
Solar Energy Research Institute
1617 Cole Boulevard
Golden, Colorado 80401 U.S.A.

National Bureau of Standards (NBS)
Solar Technology Group
Building 225, Room B-150
Washington, D.C. 20234 U.S.A.

National Energy Information Center
Office of Energy Information Services
Energy Information Administration
U.S. Department of Energy
E1-71, MS-240
1726 M Street, N.W.
Washington, D.C. 20461 U.S.A.

Technical Information Center (TIC)
U.S. Department of Energy
P.O. Box 62
Oak Ridge, Tennessee 37830 U.S.A.

NASA Lewis Research Center
Technology Utilization Office
21000 Brook Park Road
Cleveland, Ohio 44135 U.S.A.

Solar Energy Information Services (SEIS)
P.O. Box 204
18 Second Avenue
San Mateo, California 994401 U.S.A.

Volunteers in Technical Assistance (VITA)
3706 Rhode Island Avenue
Mt. Rainer, Maryland 20822 U.S.A.

GLOSSARY OF KEY TERMS

Absorber: That part of the solar collector which transforms the incident solar energy into thermal energy and transmits the energy to the heat transfer fluid.

Absorption: The process in which incident radiant energy is retained by a substance.

Absorptivity: The amount of radiant energy absorbed by a given substance of definite dimensions; the ratio of the amount of radiant energy absorbed to the total amount incident upon the substance.

Active solar system: An assembly of collectors, thermal storage units, transfer fluid, and control subsystem which converts solar energy to thermal energy.

Air-type collector: A solar-heat collector designed to use air as heat transfer fluid.

Asynchronous: An electric generator designed to produce an alternating current that matches an existing power source (e.g., utility mains) so that two sources can be combined to power one load (e.g., your home). The generator does not have to turn at a precise rpm to remain at correct frequency or phase.

Auxiliary heating/cooling system: The conventional heating or cooling system that operates when the solar system cannot perform adequately.

Average wind speed: The mean wind speed over a specific period of time.

Bioconversion: Utilization of agricultural or municipal wastes to provide fuel by either direct combustion or digestion to provide methane gas.

Biomass: Any of a number of materials, agricultural or municipal wastes, wood, etc., that can be combusted directly or bioconverted to produce methane gas.

Closed system: A system in which the liquid is heated indirectly by a separate fluid, such as a mixture of water and antifreeze. For example, this fluid circulates through the collector and may transfer its heat to water in a storage tank through a heat exchanger.

Collector: A device which collects and converts the solar radiation into heat.

Concentrating collector: A solar collector that contains reflectors, lenses, or other optical elements to concentrate the energy falling on the aperture onto a heat exchanger with a surface area smaller than the aperture.

Converter: A class of devices for performing DC/AC power conversion or "inversion."

Cover plate: Transparent material covering the aperture and most directly exposed to the solar radiation. Generally used to reduce the heat loss from the absorber to the surroundings and to protect the absorber.

Cut-in speed: The lowest wind speed below which no usable power is produced by a wind turbine.

Darrieus machine: A vertical-axis wind machine that has long, thin blades in the shape of loops connected at the top and bottom of the axle; often called "egg-beater" windmill because of its appearance.

Drain-down: Function of an open-loop solar water system in which all water drains out of the collectors when a freeze threatens.

Evacuated-tube collector: A solar collector manufactured from concentric glass tubes with an evacuated space between the outer tube and the inner absorber surface.

Evaporative cooling: Evaporating water cools and humidifies surrounding air; house air is circulated over water as a technique to cool indoor air in dry climate areas.

Flat plate collector: A solar collector in which the solid surface absorbing the incident solar radiation is essentially flat and employs no concentration. The plate is generally painted black.

Furling speed: The wind speed at which the wind machine must be shut down to prevent high wind damage.

Gear box: Converts mechanical rotary motion from a water-pumping wheel to vertical motion for pumping. The gear box can also contain a spring mechanism which allows the tail to fold parallel to the wheel in a high wind.

Gin pole: A pipe, board, or tower used to improve leverage while raising a tower.

Greenhouse effect: The ability of glass or clear plastic to transmit short-wave solar radiation into a room or collector, but to trap long-wave heat emitted by a room or a collector interior.

HVAC: Acronym for heating, ventilating, and air conditioning.

Heat exchanger: A device used to transfer heat from a fluid flowing on one side of a barrier to a colder fluid or fluids flowing on the other side.

Heat pump: A device that transfers heat from a relatively low-temperature source (atmosphere or water) to a higher temperature supply (water or air).

Heat-transfer fluid: Air or liquid used to carry solar heat from collectors to heat storage.

Hybrid solar system: A system that uses both active and passive methods, such as a solar system which uses pumps to heat and nocturnal cooling to cool.

Insolation: Amount of direct, diffuse, and/or reflected solar radiation striking a given surface per hour.

Installed capacity: The total of the rated powers of the units in a WECS facility.

Insulating glass: Glass composed of double panes, sandwiching an air space. Has approximately twice the thermal resistance of single-pane clear glass.

Insulation: Any material that provides a high resistance to the flow of heat from one surface to another. The different types are: (1) blanket or batt, (2) hose fill, (3) foam, and (4) reflective insulation.

Inverter: A device which converts d.c. to a.c. and generates its own frequency and voltage references. See also synchronous inverter.

Liquid-type collector: A solar-heat collector designed to use a liquid as heat-transfer fluid.

Low head: Refers to generation of hydroelectric power with relatively small dams.

Open system: Any system in which the same fluid is used throughout. The same fluid (usually water) which is heated in the collector is also the fluid in the storage tank, heat exchanger, etc.

Orientation: The siting of structures on a north-south orientation refers to the exposure of the major windows of the building. Since the east-west sun is the hottest, the smallest unshaded glass surfaces should face in this direction. Southern orientation gains heat from the winter sun.

Parabolic reflector: Reflector designed in the shape of a parabola in order to focus extra sunlight onto absorber of a concentrating collector.

Passive system: A solar-heating or -cooling system that uses natural processes and features of the structure windows, walls, floors, and ceilings, proper siting, etc. to capture, store, and release heat or coolness, and thereby control temperature and humidity within the structure. Heat and coolness are transmitted by natural processes of convection, conduction, gravity, etc., instead of by such mechanical devices as pumps, fans, or blowers.

Phase change: The change from one state—solid, liquid, or gaseous—to another. Associated with such a change of state is a large energy input (or release) known as the heat of fusion or vaporization.

Photovoltaic: Direct conversion of the sun's energy into electricity.

Photovoltaic cell: Small wafers, usually treated silicon, which convert sunlight into electricity.

Quad: One-quadrillion (1 by 10^{15}) Btu).

R value: A measure of the resistance to heat transfer through a material or structure.

Renewable resources: Sources of energy that are regenerative or virtually inexhaustible, such as solar energy.

Reradiation: After an object has received radiation or is otherwise heated, it often reradiates heat back. Heat that is radiated back after an object has been warmed.

Resistor: An electric device which "resists" electric current flow, used to control current (e.g., field-current in a generator).

Retrofit: To fit solar collectors to existing buildings, or more generally, any addition of a new technology to an existing structure.

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Rotor: The power-producing blades and rotating members of a wind turbine (e.g., the blades).

Selective surface: A special coating sometimes applied to the absorber plate in a solar collector. The selective surface absorbs most of the incoming solar energy and reradiates very little of it. Improves collector efficiency.

Simulation: The use of mathematical representations of real systems to determine what is likely to happen under various possible sets of conditions.

Space heating: Heating of the air inside a building.

Storage: A structure designed to receive energy in the form of heat and retain it for future use. The three primary types are fluid, chemical, and rock bed.

Tail: Mechanical fin which orients wheel to the direction of the wind.

Thermal conversion: The transformation of heat into other forms of energy such as electricity or shaft power. Heat may be supplied from the sun either directly (solar collector) or indirectly (biomass).

Thermal mass: Solid or liquid materials in which heat can be stored, usually in relation to common building materials for passive designs.

Thermosyphon water heater: A passive system that has the storage tank located above the collectors. Water or other fluid is heated in the collector, becomes lighter and rises into the storage tank. Cooler water at the bottom of the tank is denser and heavier and returns to the collector. No pumps are required in this system.

Tracking collector: A collector which moves in a continuous fashion to follow the apparent motion of the sun, thereby improving collector efficiency.

Transfer fluid: Air, water, or other fluid which passes through or comes in contact with the solar collector and carries the thermal energy away from the collector.

Trombe wall: A passive solar collection design named after Felix Trombe, which incorporates a transparent surface (glass or plastic on the outside of a darkened wall. Warm air rising between the two surfaces can be ducted inside or outside depending on the thermal requirements of the structure. Heat can also be stored in the wall.

WECS: Wind energy conversion system. A single or multi-unit wind-powered system inlcuding all system components (storage, controllers, etc.) which are integral parts of the system).

Wind turbine generator: A wind system which produces electrical power; sometimes abbreviated WTG.

Some of the above definitions were extracted from Windpower, A Handbook on Wind Energy Conversion Systems, V. Daniel Hunt (New York: Van Nostrand Reinhold Company, 1981).

ABBREVIATIONS

The following abbreviations are frequently used in COMMERCIAL NEWS USA.

A	ampere
b	bit
Bd	baud
Btu	British Thermal Unit
C	Celsius
cm	Centimeter
dB	decibel
FM	frequency modulation
g	gram
GHz	gigahertz
h	hour
ha	hectare
hp	horse power
k	kilo
kb	kilo bits
kg	kilogram
kHz	kilohertz
kl	kiloliter
km	kilometer
kV	kilovolt
kW	kilowatt
l	liter
m	meter
mg	milligram
MHz	megahertz
mHz	millihertz
MJ	mega joules (million joules)
ml	milliliter
m/s	meter per second
p/m	parts per million
r/min	revolutions per minute
s	second
t	tonne
V	volt
VA	voltampere
vhf	very high frequency
V/m	volt per meter
W	watt

Mr. GORE. You believe the export trade activities were so successful in 1981—right?

Mr. EARNSHAW. Relatively; yes.

Mr. GORE. Is it true that no money was requested for them, for fiscal year 1983?

Mr. EARNSHAW. For our trade activities?

Mr. GORE. Export trade activities.

I am talking about solar and renewable.

Mr. EARNSHAW. I think the answer lies in what the Department of Energy has been doing as compared to what we do in the normal course of events.

I believe that Energy had been subsidizing this particular industry in a variety of ways in the trade promotion area. We never have in the Commerce Department, and our intention is not to subsidize our programs.

Mr. GORE. Well, now, the House and Senate conferees on the fiscal year 1983 budget resolution have apparently agreed to a funding level for the energy function in fiscal year 1983 which is $600 million above the President's request.

Would it be a good thing for Congress to earmark $2 million of that to assist the renewable energy industry's participation in Commerce Department market development activities as recommended by the Export Council for Renewable Energy?

Mr. EARNSHAW. I would prefer not to earmark funds for special purposes in the context of our export development programs. I think it fragments our activity to the point that it becomes very difficult to manage.

I think it is much better to do exactly what we are doing, which is to focus our activities on this industry, and to encourage it to form its own activities so that we can work together.

What Energy does in terms of funding at the moment is their responsibility, not ours, but basically we seek cost recovery in our program.

Mr. GORE. What has happened to ITA's budget over the last 2 years?

Specifically, regarding export development?

Mr. EARNSHAW. Well, several things: There was a period in December of 1981 when it looked like it was going to be eliminated completely. That did not happen.

In fact, we have increased the amount of funds for both the U.S. Commercial Service and the Foreign Commercial Service, and that is important, because in order to really be helpful, both at the foreign post and in the field offices, we need the people out there to help, and so we have raised those.

In the export development activity that I am responsible for, we have reduced the number of people. We have reduced the funding, and by triggering a greater relationship with the private sector, both in the exposition area and in the general activity area, I believe that we have transferred funds from the center, if you will, to the field services and have found a way in the activities that we support to get the job done at the lower funding.

Mr. GORE. OK.

Of the renewable energy programs planned since 1980, have any events been canceled for lack of participation or other reasons?

Mr. EARNSHAW. I can't answer that specifically. I can find out and get back to the committee.

I must say, however, that whether it is a Government program or a private show program, these programs right now in these economic times are difficult to recruit.

Mr. GORE. Yes, I can imagine.

Our indication has been that 50 percent of the events have been canceled.

Fewer and fewer of them are working out.

Mr. EARNSHAW. Let me get back to you. I can't answer that one.

[The information follows:]

Since 1980, ITA has not canceled any trade events that were specifically targeted for the renewable energy industry.

Mr. GORE. You wouldn't identify any other reasons besides the recession, would you?

Mr. EARNSHAW. No, I wouldn't, really.

Mr. GORE. Does the foreign buyers program continue to play a role in renewable energy export promotion efforts?

Mr. EARNSHAW. Yes, sir, it is one of the more effective programs that we have, and, simply stated, we bring the foreign buyers to the domestic shows, or rather we ask them to come, we don't bring them.

We don't pay their way, but we promote the domestic show abroad, and if the show operator provides certain, if you will, quality control translation services, et cetera, we will endorse it and promote it abroad, and it has been a very successful activity, a very clever program.

Mr. GORE. I am interested why there is no reference to that program by name.

Mr. EARNSHAW. I did refer to it in my testimony. I am not quite sure I know what you mean, sir.

Mr. GORE. In the budget document.

Mr. EARNSHAW. Oh. OK.

In the realinement, I, or we, reorganized the export development organization, the one for which I am responsible from a functional organization to an industry-focused organization. As a result, a lot of the nomenclature disappeared. But I can assure you, and this question comes up frequently, that the foreign buyer program is receiving a high priority from me and from my people, because it is clever, and because it is successful.

Mr. GORE. I see. I guess when they get left out, that creates some nervousness.

What has happened to its funding and staff?

Mr. EARNSHAW. Its funding is, of course, in the total funding that we are operating with, No. 1.

Its staff, which originally, I think, was about six people, has been dispersed into our industry officers. However, the industry officer has as part of his responsibility, the maintenance and enhancement of the foreign buyer program, working with the industry sector for which he is responsible.

Mr. GORE. So there is no way to really compare what has happened to its funding and staff?

Mr. EARNSHAW. Not really; no. I can try and get back to you, if you like.

The whole thing is a lot more functionable now than it was.

Mr. GORE. It was one of your most successful programs when it was identifiable, and you could see it and refer to it by name?

Mr. EARNSHAW. Yes; sure.

Mr. GORE. And it was all in one place. Why would you take something like that and disburse it?

Mr. EARNSHAW. Well, because, obviously the answer is, because I thought it was the right thing to do. But beyond that, if you can have the mental picture of a trade specialist in my organization responsible for an industry and the development of that industry's export promotion program, each industry has, almost by definition, some kind of a trade show in the United States every year. You can just be certain that the foreign buyer activity as a part of that annual trade activity in the United States will be very much a part of the marketing program.

Mr. GORE. Yes.

Mr. EARNSHAW. Just because it does not show as a line item, please believe me, it does not mean that it does not exist. I believe that the foreign buyer program will be enhanced immeasurably by what we have done.

We had a capacity of running 15 buyer programs a year the way we are worked; the way we are organized, every industry can have a foreign buyer program, and we are working at least with 70 industries, and almost by definition it will get more emphasis, not less.

Mr. GORE. What does ITA hope to accomplish by working with TDP?

Mr. EARNSHAW. First of all, I should say, by way of a preamble, I was a businessman until about a year ago, when I came here, and one of the things that I perceived as not being very understandable to me was why all these different activities that seemed similar were going on in different places.

I have become convinced now, first of all, that trying to rationalize everything into one place is impossible, and would be a mistake if tried. Each area has a certain mission and a certain set of criteria that they are working to. We do work very hard to interrelate with OPIC and with TDP and AID and the Office of Private Enterprise within AID, at the working, as well as the management, level; so we all know what the other guy is doing.

The way we get hurt so badly in foreign competition is that the foreign competitors do work straight, the various programs, and they emerge very often as mixed credits which are very difficult to deal with.

Mr. GORE. Would ITA like to see some portion of Eximbank funds finance a pool of otherwise development projects which would otherwise fall outside of the Eximbank financing project under the $5 million project?

Mr. EARNSHAW. Rather than answer that specifically, I go back to what I said before. If we start to get mandates that slice the baloney, we lose our flexibility, but I am very confident in the relationship that we have with Eximbank, with the dialog that goes on, and the priorities become established along lines that are rational and hopefully successful.

Mr. GORE. The Department of Agriculture judges that the greatest effectiveness in its export programs comes from cooperation overseas with foreign agricultural service and U.S. agricultural associations.

Its agreement—the FAS agreements with these associations—originate largely from plans developed overseas by FAS and association representatives. They include matching funds and joint staffing for overseas efforts, say, joint FAS and association staff, and the result is increased resources for agricultural export promotion.

Has ITA considered adding this overseas dimension to its cooperation with U.S. industry associations?

Mr. EARNSHAW. I think the path that we are on is going to lead to that. I think that the agricultural people have an excellent promotion, export promotion program, that has been built up over probably 20 years to what it is today, and it does trigger a private sector initiative.

It does cause the cooperators to station their people abroad, both for market development and support.

It is a good program, and I suspect that as we move in our industry relationship and our industry focus, that there will be elements of the USDA program that will emerge, because they should.

Mr. GORE. It is possible to carry out all of the activities in the export development plan for renewable energy development within the existing Commerce Department budgets for fiscal year 1982 and 1983?

Mr. EARNSHAW. Yes, sir.

Mr. GORE. You think so?

Mr. EARNSHAW. Yes, sir.

Mr. GORE. OK. Would both of you be willing to respond to a short list of additional questions for the record?

Mr. EARNSHAW. Yes.

Mr. BIERMAN. Yes.

Mr. GORE. I would like to thank you both for being here. It is an important subject, and one our sister subcommittee and full committee is going to be even more interested in the years immediately ahead.

We are convinced that this is an extremely important subject, and we look forward to working with you all in the future.

Thank you all very much for helping us today.

The hearing is adjourned.

[Whereupon, at 11:50 a.m., the subcommittee adjourned, to reconvene subject to the call of the Chair.]

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